United States Environmental Protection Agency (EPA)
National Pollutant Discharge Elimination System (NPDES)

GENERAL PERMITS FOR STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS IN NEW HAMPSHIRE (as modified)

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act (CWA), as amended (33 U.S.C. §1251 *et seq.*), any operator of a small municipal separate storm sewer system whose system

- Is located in the areas described in Part 1.1;
- Is eligible for coverage under Part 1.2 and Part 1.9; and
- Submits a complete and accurate Notice of Intent in accordance with Part 1.7 of this permit and receives written authorization from EPA

is authorized to discharge in accordance with the conditions and the requirements set forth herein.

The following appendices are also included as part of these permits:
Appendix A – Definitions, Abbreviations, and Acronyms;
Appendix B – Standard permit conditions applicable to all authorized discharges;
Appendix C – Endangered Species Act Eligibility Guidance;
Appendix D – National Historic Preservation Act Eligibility Guidance;
Appendix E – Information required for the Notice of Intent (NOI);
Appendix F – Requirements for NH Small MS4s Subject to Approved TMDLs;
Appendix G – Impaired Waters Monitoring Parameter Requirements; and
Appendix H – Requirements related to discharges to certain impaired waterbodies

This modifies Parts 2.0; 2.1; 2.1.1; 2.1.2.a; 2.2; 2.2.2 (paragraphs 2 and 3); 2.3.3.1; 2.3.5; 2.3.5.3; 2.3.6.a; 2.3.7.2.b.iii; 3.1.3; 4.1.4; 4.4.2.3; Appendix A; Appendix F part III; Attachment 3 to Appendix F; and Appendix H of the permits that became effective on July 1, 2018

These permit modifications become effective on ~~July 1, 2018~~**[INSERT DATE]**.

These permits and the authorization to discharge expire at midnight on June 30, 2023.

Signed this day of

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Ken Moraff, Director
Office of Ecosystem ProtectionWater Division
United States Environmental Protection Agency
5 Post Office Square – Suite 100
Boston, Massachusetts 02109-3912

Table of Contents [TO BE UPDATED]

1.0 Introduction

2.0 Non-Numeric Effluent Limitations

This section includes terms and conditions necessary ~~The permittee shall develop, implement and enforce a program~~ to reduce the discharge of pollutants from the MS4 to the maximum extent practicable; to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act and the New Hampshire Water Quality Standards.

2.1 Water Quality Based Effluent Limitations

Pursuant to Clean Water Act 402(p)(3)(B)(iii), this permit includes provisions to ensure that discharges from the permittee's small MS4 meet applicable ~~do not cause or contribute to an exceedance of~~ water quality standards as set forth in part 2.1.1. below.~~, in addition to requirements to reduce the discharge of pollutants to the maximum extent practicable. The requirements found in this Part and Part 2.2 constitute the water quality based effluent limits of this permit. Requirements to reduce the discharge of pollutants to the maximum extent practicable are set forth in Part 2.3.~~

2.1.1 Requirement to Meet Water Quality Standards

a. The permittee's discharges shall meet applicable water quality standards[2] by complying with parts 2.1.1.b and/or 2.1.1.c in accordance with the schedules set forth therein. Any other discharge of a pollutant that: (i) is not addressed by parts 2.1.1.b, part 2.1.1.c, part 2.2.1, and/or part 2.2.2; (ii) is not the result of an illicit discharge subject to part 2.3.4; and (iii) does not meet applicable water quality standards, either independently or in conjunction with other discharges, shall comply with part 2.1.1.d. ~~permittee shall reduce the discharge of pollutants such that discharges from the MS4 do not cause or contribute to an exceedance of water quality standards.~~

b. If there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is subject to an EPA approved or established TMDL identified in Part 2.2.1, the permittee is subject to the requirements of Part 2.2.1 and Appendix F of this permit and the permittee shall comply with all applicable schedules and requirements in Appendix F for that discharge. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix F or any other schedule applicable to it will constitute compliance with Part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix F.

c. If (i)there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is water quality limited (see definition in Appendix A) due to nutrients (total nitrogen or total phosphorus), metals (cadmium, copper, iron, lead, or zinc), solids (sedimentation/siltation or turbidity), bacteria/pathogens (E. Coli, Enterococcus or fecal coliform), chloride or oil and grease (Oil Slicks, Benzo(a) pyrene (PAHs)) and is not

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[2] Applicable water quality standards are the state standards that have been federally approved or promulgated as of the issuance date of this permit and are compiled by EPA at http://www.epa.gov/waterscience/standards/wqslibrary/

subject to part 2.1.1.b. for those pollutantsan approved TMDL, or (ii)the MS4 is located within a municipality listed in Part 2.2.2.a.-b., the permittee is subject to the requirements of Part 2.2.2 and Appendix H of this permit and the permittee shall comply with all applicable schedules and requirements in Appendix H for that discharge. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix H applicable to it will constitute compliance with Part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix H.

d. Pursuant to part 2.1.1.a, upon notice from EPA to the permittee that a discharge of a pollutant from the MS4 is exceeding applicable water quality standards, the permittee must, within 60 days, remedy the exceedance or eliminate the discharge. Where such remedy or elimination within 60 days in impracticable, the permittee shall submit to EPA, by the same deadline, a schedule of actions to achieve a remedy or elimination of the discharge in the shortest time not impracticable. The permittee shall implement such actions on a schedule submitted to EPA and report on progress in its annual reports unless or until EPA takes any other action that effectively replaces the schedule. Except where a pollutant of concern in a discharge is subject to the requirements of Part 2.2.1 and/or Part 2.2.2 of this permit or is the result of an illicit discharge and subject to Part 2.3.4 of this permit, if a pollutant in a discharge from the MS4 is causing or contributing to a violation of applicable water quality criteria[3] for the receiving water, the permittee shall, as expeditiously as possible, but no later than 60 days of becoming aware of the situation, reduce or eliminate the pollutant in its discharge such that the discharge meets applicable water quality criteria.

2.1.2 Increased Discharges

a. Any increased discharge (including increased pollutant loadings) through the MS4 to waters of the United States is subject to New Hampshire antidegradation regulations. The permittee shall comply with the provisions of N.H. Code Admin. R. Part Env-Wq 1708.04 and 1708.06[4] including information submittal requirements and obtaining authorization for increased discharges where appropriate. Any authorization of an increased discharge by NH DES shall be incorporated into the permittee's SWMP. If an applicable NH DES approval specifies additional conditions or requirements related to the increased discharge, such requirements may be independently enforceable under State law and may be adopted into a future permit., then those requirements are incorporated into this permit by reference. The permittee must comply with all such requirements[5].

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2.2 Discharges to Certain Impaired Waters

The permittee shall identify in the SWMP and Annual Reports all discharges, including both

[3] Applicable water quality criteria are part of the state standards that have been federally approved as of the effective date of this permit and are compiled by EPA at http://www.epa.gov/waterscience/standards/wqslibrary/
[4] For information regarding compliance with N.H. Code Admin. R. Part Env-Wq 1708.04 and 1708.06 , contact the NHDES Watershed Management Bureau
[5] For information regarding compliance with N.H. Code Admin. R. Part Env-Wq 1708.04 and 1708.06 , contact the NHDES Watershed Management Bureau.

outfalls and interconnections to other MS4 or other separate storm sewer systems, that:

a. Are subject to an approved Total Maximum Daily Load (TMDL) as identified in Part 2.2.1;
b. Are subject to additional requirements to protect water quality as identified in Part 2.2.2.

The discharge location from an interconnection shall be determined based on the receiving water of the ultimate outfall in the interconnected system.

Permittees shall be subject to the applicable requirements in part 2.2.1, Appendix F, or an approved alternative structural control implementation schedule, and/or the applicable requirements in part 2.2.2, and Appendix H.

2.2.1 Discharges Subject to Requirements Related to an Approved TMDL

2.2.2 Discharge to Certain Water Quality Limited Waters without an Approved TMDL

For purposes of this permit, a 'water quality limited water body' is any water body that does not meet applicable water quality standards, including but not limited to waters listed in categories 5 or 4b on the most recent EPA-approved New Hampshire Clean Water Act section 303(d) list or New Hampshire Integrated Report under Clean Water Act section 305(b).

If there is a discharge from the MS4 to a water quality limited waterbody where pollutants typically found in stormwater (specifically nutrients (Total Nitrogen or Total Phosphorus), solids (Sedimentation/Siltation or Turbidity), bacteria/pathogens (Enterococcus, fecal coliform, or Escherichia Coli), chloride (Chloride), metals (Cadmium, Copper, Iron, Lead or Zinc) and oil and grease (Oil Slicks, Benzo(a) pyrene (PAHs)) are the cause of the impairment and is not subject to part 2.1.1.b for those pollutants~~there is not an approved TMDL~~, or the MS4 is located in a town listed in Part 2.2.2.a.-e. the permittee shall comply with the provisions in Appendix H applicable to it. Permittees notified by EPA during the permit term that they are discharging to a water quality limited water shall update their SWMP in accordance with Appendix H.

In the absence of a defined pollutant reduction target and where no approved TMDL has been established as of the issuance date of this permit, this permit Part and Appendix H define an iterative approach addressing pollutant reductions to waterbodies where the permittee's discharge is ~~causing or contributing to an excursion above~~not meeting applicable water quality standards due to nutrients (nitrogen or phosphorus), solids, bacteria/pathogens, chloride, metals or oil and grease (Oil Slicks, Benzo(a) pyrene (PAHs)).

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2.3 Requirements to Reduce Pollutants to the Maximum Extent Practicable (MEP)

The permittee shall reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP), as set forth in Parts 2.3.2 through 2.3.7.

2.3.1 Control Measures

2.3.2 Public Education and Outreach

2.3.3 Public Involvement and Participation

Objective: The permittee shall provide opportunities to engage the public to participate in the review and implementation of the permittee's SWMP.

2.3.3.1 - All public involvement activities shall comply with state public notice requirements (NH: RSA Chapter 91-A). The SWMP (consistent with Part 1.10.1), all documents submitted to EPA in accordance with Appendix F, and all annual reports shall be available to the public. The permittee is encouraged to satisfy this requirement by posting records online.

2.3.3.2 - The permittee shall annually provide the public an opportunity to participate in the review and implementation of the SWMP.

2.3.3.3 - The permittee shall report on the activities undertaken to provide public participation opportunities including compliance with Part 2.3.3.1. Public participation opportunities pursuant to Part 2.3.3.2 may include, but are not limited to, websites; hotlines; clean-up teams; monitoring teams; or an advisory committee.

2.3.4. Illicit Discharge Detection and Elimination (IDDE) Program

2.3.5 Construction Site Stormwater Runoff Control

Objective: The objective of an effective construction stormwater runoff control program is to minimize or eliminate erosion and maintain sediment on construction sites so that it is not transported in stormwater and allowed to discharge to a water of the U.S. through the permittee's MS4.

The construction site stormwater runoff control program required by this permit is a separate and distinct program from EPA's Construction General Permit in that the former is implemented by the MS4 operator to ensure that runoff from construction sites discharging to the MS4 are controlled consistent with the MS4's applicable requirements, whereas the latter is implemented by construction site operators to comply with the terms and conditions of EPA's permit (https://www.epa.gov/npdes/2017-construction-general-permit-cgp)~~stormwater construction permit program (see https://www.epa.gov/npdes/stormwater-discharges-construction-activities#cgp for further information)~~.

2.3.5.1 – Permittees shall implement and enforce a program to reduce pollutants in any stormwater runoff discharged to the MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. The permittee's program shall include disturbances less than one acre if that disturbance is part of a larger common plan of development or sale that would disturb one acre or more. Permittees authorized under the MS4-2003 shall continue to implement their existing programs and shall modify them as necessary to meet the requirements of this Part.

2.3.5.2 - The permittee does not need to apply its construction program requirements to projects that receive a waiver from EPA under the provisions of 40 CFR § 122.26(b)(15)(i).

2.3.5.3 - The construction site stormwater runoff control program shall include the elements in Paragraphs a. through c.~~e~~ of this Part:

a. An ordinance or other regulatory mechanism that requires the use of sediment and erosion control practices at construction sites. In addition to addressing sediment and erosion control, the ordinance must include controls for other wastes on constructions sites such as demolition debris, litter and sanitary wastes. The ordinance or regulatory mechanism shall provide that the permittee may, to the extent authorized by law, impose sanctions to ensure compliance with the local program. Development of an ordinance or other regulatory mechanism was a requirement of the MS4-2003 (See Part III.B.4) and was required to be effective by May 1, 2008.

b. Written procedures (hardcopy or electronic) for site plan review, site inspections and enforcement of sediment and erosion control measures by the permittee. If not already existing, these procedures shall be completed within one (1) year from the effective date of the permit. ~~The procedures shall clearly define who is responsible for site inspections as well as who has authority to implement enforcement procedures. The program shall provide that the permittee may, to the extent authorized by law, impose sanctions to ensure compliance with the local program.~~ These procedures and regulatory authorities shall be documented in the SWMP. The permittee shall track the number of site reviews, inspections, and enforcement actions. This information shall be included as part of each annual report required by Part 4.4.

   1. The site plan review procedure shall include:
      - pre-construction review by the permittee of the site design, the planned operations at the construction site, planned BMPs during the construction phase, and the planned BMPs to be used to manage runoff created after development;
      - consideration of potential water quality impacts;
      - procedures for receipt and consideration of information submitted by the public; and
      - evaluation of the incorporation of Low Impact Development (LID) site planning and design strategies, unless such practices are infeasible.

   2. The site inspection and enforcement procedures shall include:
      - who is responsible for site inspections as well as who has authority to implement enforcement procedures.

c. Requirements for construction operators to implement a sediment and erosion control program. The program shall include BMPs appropriate for the conditions at the construction site. The program may include references to the requirements of EPA's Construction general Permit (including the development of a SWPPP) to the extent they are consistent with the program requirements of this part. The program may include references to BMP design standards in state manuals or design standards specific to the MS4. EPA supports and encourages the use of design standards in local programs. Examples of appropriate sediment and erosion control measures for construction sites include local requirements to:

- minimize the amount of disturbed area and protect natural resources;
- stabilize sites when projects are complete or operations have temporarily ceased;
- protect slopes on the construction site;
- protect all storm drain inlets and armor all newly constructed outlets;
- use perimeter controls at the site;
- stabilize construction site entrances and exits to prevent off-site tracking; and
- control wastes that may be discharged, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes (these wastes may not be discharged to the MS4); and
- inspect stormwater controls at consistent intervals.

d. Requirements to control wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes. These wastes may not be discharged to the MS4.

e. Written procedures (hardcopy or electronic) for site plan review. If not already existing, the procedure for site plan review shall be completed within one (1) year from the effective date of the permit. Site plan review shall include a review by the permittee of the site design, the planned operations at the construction site, planned BMPs during the construction phase, and the planned BMPs to be used to manage runoff created after development. The review procedure shall incorporate procedures for the consideration of potential water quality impacts; procedures for pre-construction review; and procedures for receipt and consideration of information submitted by the public. Site plan review procedure shall include evaluation of opportunities for use of low impact design and green infrastructure. When the opportunity exists, the permittee shall encourage project proponents to incorporate these practices into the site design. The permittee shall track the number of site reviews, inspections, and enforcement actions. This information shall be included as part of each annual report required by Part 4.4.

2.3.6 Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management)

Objective: The objective of this control measure is to minimize the water quality impact from new development and reduce the water quality impact due to stormwater runoff from a redeveloped site.

a. Permittees shall develop, implement, and enforce a program to address post-construction stormwater runoff from all new development and redevelopment projects[11] that disturb a minimum of one or more acre(s) and discharge into the permittees MS4 at a minimum. The permittee's new development/ redevelopment program shall include projects less than one acre if the project is part of a larger common plan of development or redevelopment which disturbs one or more acre.- Permittees authorized under the MS4-2003 permit shall continue to implement and enforce their program and modify as

[11] See Appendix A for definitions of new development and redevelopment.

necessary to meet the requirements of this Part.

i. The permittee's new development/ redevelopment program shall include projects less than one acre if the project is part of a larger common plan of development or redevelopment which disturbs one or more acre.

i.ii. The permittee listed in part 2.3.6.a.i.1 below shall develop or modify, as appropriate, an ordinance or other regulatory mechanism within two (2)three (3) years of the effective date of the permit to be consistent with this part. Permittees shall consider the adoption of the Section 4 Element C and Element D of the Southeast Watershed Alliance's Model Stormwater Standards for Coastal Watershed Communities (SWA Model Standards).[12]; OR contain provisions that are as least as stringent as the following: At a minimum, the ordinance or other regulatory mechanisms must include water quality requirements at least as stringent as the requirements contained in Section 4 Element C.1, C.3.b, C.3.e, C.3.h[13], and Section 4 Element D of the SWA Model Standards.

1.

Danville
Dover
Durham
Exeter
Greenland
Hampton
Kingston
Milton
New Castle
Newmarket
North Hampton
Portsmouth
Raymond
Rye
Rochester
Rollinsford
Sandown
Seabrook

[12] Model Stormwater Standards for Coastal Watershed Communities, Southeast Watershed Alliance, December 2012. https://southeastwatershedalliance.org/wp/wp-content/uploads/2017/02/Final_SWA_SWStandards_Dec_2012.pdfhttp://southeastwatershedalliance.org/wp-content/uploads/2013/05/Final_SWA_SWStandards_Dec_20121.pdf.

[13] Pollutant removal calculations must be developed consistent with EPA Region 1's BMP Accounting and Tracking Tool (2016) or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance, any federally- or state-approved BMP design guidance or performance standards (e.g. State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance. Pollutant removal is calculated based on average annual loading and not on the basis of any individual storm event.

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Stratham

ii. Permittees not listed in part 2.3.6.a.i.1 above shall develop or modify, as appropriate, an ordinance or other regulatory mechanism within three (3) years of the effective date of the permit consistent with the requirements of part 2.3.6.a.i, except for the Total Nitrogen removal requirement of Section 4 Element C.3.h[14] of the SWA Model Standards.

a) Low Impact Development (LID) site planning and design strategies must be used to the maximum extent feasible in order to reduce the discharge of stormwater from new development.

b) Salt storage areas on commercial and industrial new and redevelopment sites shall be covered and loading/offloading areas shall be designed and maintained in accordance with NH DES published guidance (Fact Sheets WD-WMB-4[15] and WD-DWGB-22-30[16]) such that no untreated discharge to receiving waters results. Snow storage areas shall be located in accordance with NH DES published guidance (Fact Sheets WD-WMB-4 and WD-DWGB-22-30) such that no direct untreated discharges to receiving waters are possible from the storage site. Runoff from snow and salt storage areas shall enter treatment areas as specified above before being discharged to receiving waters or allowed to infiltrate into the groundwater.

c) The selection and design of treatment and infiltration practices shall follow the guidance in Volume 2 of the New Hampshire Stormwater Manual[17], where applicable.

d) Post construction stormwater runoff from new development sites shall be controlled by:

1) Retention or treatment of stormwater runoff to the MS4 by one of the following:
   a. Require BMPs that are designed to retain the Water Quality Volume calculated in accordance with N.H. Code Admin. R. Part Env-Wq 1504.10. OR

[14] See footnote 13.
[15] Environmental Fact Sheet: Road Salt and Water Quality, New Hampshire Department of Environmental Services, 2016. http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf.
[16] Environmental Fact Sheet: Storage and Management of Deicing Materials, New Hampshire Department of Environmental Services, 2011. http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-22-30.pdf.
[17] New Hampshire Stormwater Manual Volume 2: Post-Construction Best Management Practices Selection & Design, New Hampshire Department of Environmental Services, December, 2008. http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20b.pdf.

b. Require BMPs that are designed to remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area[18] AND 60% of the average annual load of Total Phosphorus (TP) generated from the total post-construction impervious area[19]. Pollutant removal shall be evaluated consistent with Attachment 3 to Appendix F and the Stormwater Best Management Practices (BMP) Performance Analysis[20] or other tools provided by EPA Region 1 consistent with these resources. If EPA Region 1 tools do not address the planned or installed BMP performance any federally or State approved[21] BMP design guidance or performance standards (e.g. State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance.

2) Implement long term maintenance practices of BMPs in accordance with N.H. Code Admin. R. Part Env-Wq 1507.08.

e) Post construction stormwater runoff from redevelopment sites shall be controlled by:

4) Retention or treatment of stormwater runoff from the disturbed portion of the redevelopment site to the MS4 by one of the following:

a. Require BMPs that are designed to retain or treat the Water Quality Volume calculated in accordance with N.H. Code Admin. R. Part Env-Wq 1504.10 and be designed to remove pollutants in accordance with N.H. Code Admin. R. Part Env-Wq 1507.03; OR

b. Require BMPs that remove 80% of the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area[22] AND 50% of the average annual load of Total Phosphorus (TP) generated from the total post-construction impervious surface[23]. Pollutant removal shall be calculated consistent with EPA Region 1's BMP Performance Extrapolation Tool or other BMP performance evaluation tool provided by EPA Region 1, where available. If

[18] The required removal percentage is not required for each storm, it is the average removal over a year that is required

[19] The required removal percentage is not required for each storm, it is the average removal over a year that is required

[20] Stormwater Best Management Practices (BMP) Performance Analysis, Tetra Tech, Inc. for U.S. EPA Region 1, Rev. March 2010. https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/BMP-Performance-Analysis-Report.pdf.

[21] State approved includes any state in the United States, including, but not limited to, approved guidance by the State of New Hampshire

[22] The required removal percentage is not required for each storm,it is the average removal over a year that is required

[23] The required removal percentage is not required for each storm,it is the average removal over a year that is required

~~EPA Region 1 tools do not address the planned or installed BMP performance, any federally or State approved[24] BMP design guidance or performance standards (e.g. State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance.~~

~~5) Implement long term maintenance practices of BMPs in accordance with N.H. Code Admin. R. Part Env-Wq 1507.08.~~

~~6) Offsite mitigation within the same USGS HUC10 or smaller watershed as the redevelopment site may be used to meet the pollutant removal equivalent of the requirements in Part 2.3.6(a)ii.(e)(1)b. and the equivalent groundwater recharge requirements of Part 2.3.6(a)ii.(e)(2) above.~~

~~f) Redevelopment that disturbs greater than 1 acre and is exclusively maintenance and improvement of existing roadways shall be exempt from Part 2.3.6(a)ii.(e). Roadway maintenance or improvements that increase the amount of impervious area on the redevelopment site shall meet the requirements of Part 2.3.6(a)ii.(e) fully.~~

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2.3.7 Good House Keeping and Pollution Prevention for Municipal Operations

Objective: The permittee shall implement an operations and maintenance program for permittee operations that includes a training component and has a goal of preventing or reducing pollutant runoff and protecting water quality from all permittee operations.

2.3.7.1 - Operations and Maintenance (O & M) Programs

2.3.7.2 Stormwater Pollution Prevention Plan (SWPPP)

The permittee shall develop and fully implement a SWPPP for each of the following permittee-owned or operated facilities: maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater. If facilities are located at the same property, the permittee may develop one SWPPP for the entire property. The SWPPP is a separate and different document from the SWMP required in Part 1.10. A SWPPP does not need to be developed for a facility if the permittee has either developed a SWPPP or received a no exposure certification for the discharge under the Multi-Sector General Permit or the discharge is authorized under another NPDES permit.

a. No later than two years from the effective date of the permit, the permittee shall develop and implement a written SWPPP for the facilities described above. The SWPPP shall be signed in accordance with the signatory requirements of Appendix B – Subparagraph 11.

b. The SWPPP shall contain the following elements:

~~[24] State approved includes any state in the United States, including, but not limited to, approved guidance by the State of New Hampshire~~

i. Pollution Prevention Team
Identify the staff on the team, by name and title. If the position is unstaffed, the title of the position will be included and the SWPPP updated when the position is filled. The role of the team is to develop, implement, maintain, and revise, as necessary, the SWPPP for the facility.

ii. Description of the facility and identification of potential pollutant sources. The SWPPP shall include a map of the facility and a description of the activities that occur at the facility. The map shall show the location of the stormwater outfalls, receiving waters, and any structural controls. Identify all activities that occur at the facility and the potential pollutants associated with each activity including the location of any floor drains. These may be included as part of the inventory required by Part 2.3.7.1.

iii. Identification of stormwater controls. The permittee shall select, design, install, and implement the control measures detailed in paragraph iv below to prevent or reduce the discharge of pollutants from the permittee owned facility.

The selection, design, installation, and implementation of the control measures shall be in accordance with good engineering practices and manufacturer's specifications. The permittee shall also take all reasonable steps to control or address the quality of discharges from the site that may not originate at the facility.

If the discharge from the facility is to an impaired water and the facility has the potential to discharge the pollutant identified as causing the impairment, the permittee shall identify the control measures that will be used to address this pollutant at the facility so that the discharge meets applicable water quality standards.~~does not cause or contribute to a violation of a water quality standard~~.

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3.0 Additional State Requirements

3.1 Requirements for MS4s in New Hampshire

The permittee shall evaluate physical conditions, site design, and best management practices to promote ground water recharge and infiltration where feasible in the implementation of the control measures described in Part 2.3. The permittee shall address recharge and infiltration for the control measures, as well as any reasons for electing not to implement recharge and infiltration. Loss of annual recharge to ground water should be minimized through the use of infiltration to the maximum extent practicable. Any subsurface disposal of stormwater shall be in accordance with applicable groundwater, source water protection and underground injection control requirements (see Part 1.3.j).

3.1.1. Infiltration through stormwater practices shall be prohibited under certain circumstances, including:

a. When stormwater originates from gasoline dispensing areas at locations with state registered underground storage tanks (UST) and above ground storage tanks (AST);

b. Within groundwater protection areas (defined under N.H. Code Admin. R. Part Env-Wq 1502.24) when stormwater originates from land uses considered a "high load area" under N.H. Code Admin. R. Part Env-Wq 1502.26; and
c. Within areas that have contaminants in groundwater above the ambient groundwater quality standards established in N.H. Code Admin. R. Part Env-Or 603.03 or in soil above site-specific soil standards developed pursuant to Env-Or 600.

3.1.2. MS4s that discharge to coastal waters with public swimming beaches shall consider these waters a priority in implementation of the stormwater management program.

~~3.1.3. When updating stormwater ordinances as required in Part 2.3.6, permittees must consider adding the provisions identified in N.H. Code Admin. R. Part Env-Wq 1507.04 for groundwater recharge, N.H. Code Admin. R. Part Env-Wq 1507.05 for channel protection, and N.H. Code Admin. R. Part Env-Wq 1507.06 for peak runoff control. The last two will help communities to address concerns about streambank erosion and flooding which may cause both water quality violations and significant property damage or loss of life.~~

3.2 New Hampshire Public Drinking Water Requirements

3.2.1 MS4s that discharge to public drinking water sources and their source protection areas must consider these sources priority resources when implementing the control measures of Part 2.3.

3.2.2 Discharge to public drinking water supply sources and their protection areas must provide pretreatment and spill control suitable to protect drinking water sources to the extent feasible.

3.2.3 – The permittee shall avoid direct discharges to groundwater and surface water drinking water sources and ensure any discharges near source protection areas of water supply wells or intakes comply with the applicable state requirements. Stormwater systems shall meet the minimum discharge setback requirements of N.H. Code Admin. R. Part Env-Wq 1500 unless exempt under N.H. Code Admin. R. Part Env-Wq 1508.02(c). The following minimum setbacks apply to certain drinking water supply resources, including:

a. Discharge setbacks from water supply wells in accordance with N.H. Code Admin. R. Part Env-Wq 1508.02(a); and
b. Discharge setback of 100 feet within water supply intake protections areas as specified under N.H. Code Admin. R. Part Env-Wq 1508(b).

In groundwater protection areas and water supply intake protection areas, infiltration and filtration practices shall provide additional vertical separation to the seasonal high water table in accordance with N.H. Code Admin. R. Part Env-Wq 1500 within local regulations for projects not subject to N.H. Code Admin. R. Part Env-Wq 1500.

The permittee is encouraged to adopt similar requirements or reference these state rule requirements under N.H. Code Admin. R. Part Env-Wq 1500 within local regulations for projects not subject to N.H. Code Admin. R. Part Env-Wq 1500.

3.2.4 – The permittee shall develop and implement a plan to notify public water suppliers in the event of an emergency which has the potential to impact a water supply.

4.0 Program Evaluation, Record Keeping, and Reporting

4.1 Program Evaluation

4.1.1 The permittee shall annually self-evaluate its compliance with the terms and conditions of this permit. The permittee shall maintain the annual evaluation documentation as part of the SWMP.

4.1.2 The permittee shall evaluate the appropriateness of the selected BMPs in achieving the objectives and requirements of each control measure and the defined measurable goals. The permittee may change BMPs in accordance with the following provisions:

a. Changes adding (but not subtracting or replacing) components or controls may be made at any time.
b. Changes replacing an ineffective or infeasible BMP specifically identified in the SWMP with an alternative BMP may be made if the proposed changes meet the criteria below:

4.1.3 BMP modification documentation shall include the following information and all documentation shall be kept in the SWMP:

a. An analysis of why the BMP is ineffective or infeasible;
b. Expectations on the effectiveness of the replacement BMP; and
c. An analysis of why the replacement BMP is expected to achieve the defined goals of the BMP to be replaced.

The permittee shall indicate BMP modifications along with a brief explanation of the modification in each Annual Report.

4.1.4 EPA ~~or the state agency~~ may ~~require~~ request the permittee to add, modify, repair, replace or change BMPs or other measures described in the annual reports as needed to satisfy the conditions of this permit.~~:~~

~~a. To address impacts to receiving water quality caused or contributed to by discharges from the MS4; or~~
~~b. To satisfy conditions of this permit.~~

Any changes requested by EPA ~~or the state agency~~ will be in writing and ~~will~~ may set forth the schedule for the permittee to develop the changes and ~~will~~ may offer the permittee the opportunity to propose alternative program changes to ~~meet the objective of the requested modification~~ satisfy the permit conditions.

4.2 Record Keeping

4.3 Outfall monitoring

4.4 Annual Reporting

4.4.1 The permittee shall submit an annual report. The reporting period will be a one year period commencing on July 1, 2018, and subsequent anniversaries thereof, except that the first annual report under this permit shall also cover the period from May 1, 2018 to July 1, 2018. The annual report is due ninety days from the close of each reporting period.

4.4.2 The annual reports shall contain the following information:

4.4.2.1 A self-assessment review of compliance with the permit terms and conditions.

4.4.2.2 An assessment of the appropriateness of the selected BMPs.

4.4.2.3 The status of the any plans or activities required by Part 2.1 and/ or Part 2.2, including:

a. For discharges subject to TMDLs, a description of BMPs implemented to comply with the applicable Part(s) of Appendix F;
b. For discharges to certain impaired waters (and their tributaries for nutrient-impaired waters), a description of BMPs implemented to comply with the applicable Part(s) of Appendix H~~F~~

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5.0 Non-Traditional MS4s

6.0 Requirements for Transportation Agencies

Appendix A

Definitions, Abbreviations and Acronyms

Definitions

Best Management Practices (BMPs) - schedules of activities, practices (and prohibitions of practices), structures, vegetation, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Control Measure - refers to any BMP or other method (including effluent limitations) used to prevent or reduce the discharge of pollutants to waters of the United States.

Director - a Regional Administrator of the Environmental Protection Agency or an authorized representative.

Discharge - when used without qualification, means the "discharge of a pollutant."

Discharge of a pollutant - any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source," or any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. This includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

Discharge-related activities - activities which cause, contribute to, or result in stormwater and allowable non-stormwater point source discharges, and measures such as the siting, construction and operation of BMPs to control, reduce, or prevent pollution in the discharges.

Disturbance - action to alter the existing vegetation and/or underlying soil of a site, such as clearing, grading, site preparation (e.g., excavating, cutting, and filling), soil compaction, and movement and stockpiling of top soils.

Existing Discharger – an operator applying for coverage under this permit for discharges covered previously under an NPDES general or individual permit.

Facility or Activity - any NPDES "point source" or any other facility or activity (including land or appurtenances thereto) that is subject to regulation under the NPDES program.

Federal Facility – Any buildings, installations, structures, land, public works, equipment, aircraft, vessels, and other vehicles and property, owned by, or constructed or manufactured for the purpose of leasing to, the federal government.

Illicit Discharge - any discharge to a municipal separate storm sewer that is not composed entirely of stormwater except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities.

Impaired Water – A water is impaired if it does not meet one or more of its designated use(s). For purposes of this permit, 'impaired' refers to categories 4 and 5 of the five part categorization approach used for classifying the water quality standards attainment status for water segments under the TMDL program. Impaired waters compilations are also sometimes referred to as "303(d) lists". Category 5 waters are impaired because at least one designated use is not being supported or is threatened and a TMDL is needed. Category 4 waters indicate that at least one designated use is not being supported but a TMDL is not needed (4a indicates that a TMDL has been approved or established by EPA; 4b indicates other required control measures are expected in result in the attainment of water quality standards in a reasonable period of time; and 4c indicates that the non-attainment of the water quality standard is the result of pollution (e.g. habitat) and is not caused by a pollutant. See *USEPA's 2006 Integrated Report Guidance, July 29, 2005* for more detail on the five part categorization of waters [under EPA National TMDL Guidance http://www.epa.gov/owow/tmdl/policy.html]).

Impervious Surface- Any surface that prevents or significantly impedes the infiltration of water into the underlying soil. This can include but is not limited to: roads, driveways, parking areas and other areas created using non porous material; buildings, rooftops, structures, artificial turf and compacted gravel or soil.

Industrial Activity - the 10 categories of industrial activities included in the definition of "stormwater discharges associated with industrial activity", as defined in CFR § 122.26(b)(14)(i)-(ix) and (xi).

Industrial Stormwater - stormwater runoff associated with the definition of "stormwater discharges associated with industrial activity."

Infeasible – not technologically possible, or not economically practicable and achievable in light of best industry practices.

Junction Manhole - For the purposes of this permit, a junction manhole is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these purposes.

Key Junction Manhole - For the purposes of this part, key junction manholes are those junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. Adequate implementation of the illicit discharge program would not be compromised if the exclusion of a particular junction manhole as a key junction manhole would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

Municipal Separate Storm Sewer - a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

(i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States;
(ii) Designed or used for collecting or conveying stormwater;
(iii) Which is not a combined sewer; and
(iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

New Development ~~– any construction activities or land alteration resulting in total earth disturbances greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) on an area that has not previously been developed to include impervious cover. (see part 2.3.6. of the permit)~~ for the purposes of part 2.3.6., any construction, land alteration, or improvement of a site or structure with less than 40 percent existing impervious surface, calculated by dividing the total existing impervious surface by the size of the parcel and convert to a percentage.

New Source - any building, structure, facility, or installation from which there is or may be a "discharge of pollutants," the construction of which commenced:

- after promulgation of standards of performance under section 306 of the CWA which are applicable to such source, or
- after proposal of standards of performance in accordance with section 306 of the CWA which are applicable to such source, but only if the standards are promulgated in accordance with section 306 within 120 days of their proposal.

New Source Performance Standards (NSPS) – Technology-based standards for facilities that qualify as new sources under 40 CFR 122.2 and 40 CFR 122.29.

No exposure - all industrial materials or activities are protected by a storm-resistant shelter to prevent exposure to rain, snow, snowmelt, and/or runoff.

Owner or operator - the owner or operator of any "facility or activity" subject to regulation under the NPDES program.

Outfall – a point source as defined by 40 CFR 122.2 (and below) at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States.

Person - an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

Point source - any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

Pollutant - dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal and agricultural waste discharged into water.

Pollutant of concern – A pollutant which causes or contributes to a violation of a water quality standard, including a pollutant which is identified as causing an impairment in a State's 303(d) list.

Reportable Quantity Release – a release of a hazardous substance at or above the established legal threshold that requires emergency notification. Refer to 40 CFR Parts 110, 177, and 302 for complete definitions and reportable quantities for which notification is required.

Redevelopment – for the purposes of part 2.3.6., A site is considered a redevelopment if it has 40 percent or more of existing impervious surface, calculated by dividing the total existing impervious surface by the size of the parcel and convert to a percentage.~~any construction, land alteration, or improvement of impervious surfaces resulting in total earth disturbances greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) that does not meet the definition of new development (see above). of a site with existing man-made land alterations.~~

Runoff coefficient - the fraction of total rainfall that will appear at the conveyance as runoff.

Significant materials - includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharges.

Site – for the purposes of part 2.3.6., the area extent of construction activities, including but not limited to the creation of new impervious cover and improvement of existing impervious cover (e.g. repaving not covered by 2.3.6.a.ii.4.d.)

Small Municipal Separate Storm Sewer System – means all separate storm sewer systems that are (i) owned or operated by the United States, a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district, or drainage district, or similar entity or an Indian tribe or an authorized Indian tribal organization or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States. (ii) Not defined as "large" or "medium" municipal separate storm sewer system pursuant to paragraphs 40 CFR 122.26 (b)(4) and (b)(7), or designated under paragraph 40 126.26(a) (1)(v). (iii) This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. This term does not include separate storm sewers in very discrete areas, such as individual buildings.

Small MS4 – means a small municipal separate storm sewer system.

Stormwater - stormwater runoff, snow melt runoff, and surface runoff and drainage.

Stormwater Discharges Associated with Construction Activity - a discharge of pollutants in stormwater runoff from areas where soil disturbing activities (e.g., clearing, grading, or excavating), construction materials, or equipment storage or maintenance (e.g., fill piles, borrow areas, concrete truck washout, fueling), or other industrial stormwater directly related to the construction process (e.g., concrete or asphalt batch plants) are located. (See 40 CFR 122.26(b)(14)(x) and 40 CFR 122.26(b)(15).

Stormwater Discharges Associated with Industrial Activity - the discharge from any conveyance that is used for collecting and conveying stormwater and that is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. The term does not include discharges from facilities or activities excluded from the NPDES program under Part 122. For the categories of industries identified in this section, the term includes, but is not limited to, stormwater discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at part 401 of this chapter); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and final products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to stormwater. For the purposes of this paragraph, material handling activities include storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product, by-product or waste product. The term excludes areas located on plant lands separate from the plant's industrial activities, such as office buildings and accompanying parking lots as long as the drainage from the excluded areas is not mixed with stormwater drained from the above described areas. Industrial facilities include those that are federally, State, or municipally owned or operated that meet the description of the facilities listed in Appendix D of this permit. The term also includes those facilities designated under the provisions of 40 CFR 122.26(a)(1)(v).

Total Maximum Daily Loads (TMDLs) - A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL includes wasteload allocations (WLAs) for point source discharges; load allocations (LAs) for nonpoint sources and/or natural background, and must include a margin of safety (MOS) and account for seasonal variations. (See section 303(d) of the Clean Water Act and 40 CFR §130.2 and §130.7).

Water Quality Limited Water – for the purposes of this permit, a water quality limited water is any waterbody that does not meet applicable water quality standards, including but not limited to waters listed in categories 5 or 4b on the most recent (as of the permit effective date) EPA-approved New Hampshire Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b).

Water Quality Standards: A water quality standard defines the water quality goals of a water body, or portion thereof, by designating the use or uses to be made of the water and by setting criteria necessary to protect the uses. States and EPA adopt WQS to protect public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act (See CWA sections 101(a)2 and 303(c)).

ABBREVIATIONS AND ACRONYMS

BMP – Best Management Practice

BPJ – Best Professional Judgment

CGP – Construction General Permit

CWA – Clean Water Act (or the Federal Water Pollution Control Act, 33 U.S.C. §1251 *et seq*)

DCIA – Directly Connected Impervious Area

EPA – U. S. Environmental Protection Agency

ESA – Endangered Species Act

FWS – U. S. Fish and Wildlife Service

IA – Impervious Area

IDDE – Illicit Discharge Detection and Elimination

LA – Load Allocations

MOS – Margin of Safety

MS4 – Municipal Separate Storm Sewer System

MSGP – Multi-Sector General Permit

NAICS – North American Industry Classification System

NEPA – National Environmental Policy Act

NHPA – National Historic Preservation Act

NMFS – U. S. National Marine Fisheries Service

NOI – Notice of Intent

NPDES – National Pollutant Discharge Elimination System

NRC – National Response Center

NRHP – National Register of Historic Places

NSPS – New Source Performance Standard

NTU – Nephelometric Turbidity Unit

OMB – U. S. Office of Management and Budget ORW

– Outstanding Resource Water

PCP – Phosphorus Control Plan

POTW – Publicly Owned Treatment Works

RCRA – Resource Conservation and Recovery Act RQ

– Reportable Quantity

SHPO – State Historic Preservation Officer

SIC – Standard Industrial Classification

SPCC – Spill Prevention, Control, and Countermeasure

SWMP – Stormwater Management Program

SWPPP – Stormwater Pollution Prevention Plan

TMDL – Total Maximum Daily Load

TSS – Total Suspended Solids

USGS – United States Geological Survey

WLA – Wasteload Allocation

WQRP – Water Quality Response Plan

WQS – Water Quality Standard

APPENDIX F

REQUIREMENTS OF APPROVED TOTAL MAXIMUM DAILY LOADS

I. Chloride TMDLs

Permittees that operate regulated MS4s in the municipalities identified in Derry, Londonderry, Salem and Windham that discharge to Beaver Brook; Dinsmore Brook; North Tributary to Canobie Lake; Policy-Porcupine Brook, and any other permittee that discharges to those waterbodies, shall reduce chloride discharges to support achievement of the WLA included in the applicable approved TMDL[1] by complying with EITHER Appendix F Part I.1 or Appendix F Part I.2 below.

1. The permittee shall develop a Chloride Reduction Plan that includes specific actions designed to achieve chloride reduction on municipal roads and facilities, and on private facilities that drain to the MS4. The Chloride Reduction Plan shall be completed within one (1) year of the effective date of the permit and shall include, at a minimum:

   a. For municipally maintained surfaces:

      i. Tracking of the amount of salt applied to all municipally owned and maintained surfaces and reporting of salt use using the UNH Technology Transfer Center online tool (http://www.roadsalt.unh.edu/Salt/) beginning in the year 2 annual report;
      ii. Planned activities for salt reduction on municipally owned and maintained surfaces, which may include but are not limited to:
         - Operational changes such as pre-wetting, pre-treating the salt stockpile, increasing plowing prior to de-icing, monitoring of road surface temperature, etc.;
         - Implementation of new or modified equipment providing pre-wetting capability, better calibration rates, or other capability for minimizing salt use;
         - Training for municipal staff and/or contractors engaged in winter maintenance activities;
         - Adoption of guidelines for application rates for roads and parking lots (see NHDES, Chloride Reduction Implementation Plan for Dinsmore Brook, App. J and K (February 2011); Winter Parking Lot and Sidewalk Maintenance Manual (Revised edition June 2008); and the application guidelines on page 17 of Minnesota Snow and Ice Control: Field Handbook for Snow Operators (September 2012) for examples);
         - Regular calibration of spreading equipment;
         - Designation of no-salt and/or low salt zones;

[1] Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Beaver Brook in Derry and Londonderry, NH (2008), Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Dinsmore Brook in Windham, NH (2008), Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: North Tributary to Canobie Lake in Windham, NH (2008), Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Policy-Porcupine Brook in Salem and Windham, NH (2008)

- Public education regarding impacts of salt use, methods to reduce salt use on private property, modifications to driving behavior in winter weather, etc.; and
- Measures to prevent exposure of salt stockpiles (if any) to precipitation and runoff; and

iii. An estimate of the total tonnage of salt reduction expected by each activity; and

iv. A schedule for implementation of planned activities including immediate implementation of operational and training measures, continued annual progress on other measures, and full implementation of the Plan by the end of the permit term.

b. For privately maintained facilities that drain to the MS4:

i. Identification of private parking lots with 10 or more parking spaces draining to the MS4;

ii. Requirements for private parking lot owners and operators and private street owners and operators (1) that any commercial salt applicators used for applications of salt to their parking lots or streets be trained and certified in accordance with Env-Wq 2203, and (2) to report annual salt usage within the municipal boundaries using the UNH Technology Transfer Center online tool (http://www.roadsalt.unh.edu/Salt/) or report salt usage directly to the permittee, in which case this information should be reported on the permittees annual report.

iii. Requirements for new development and redevelopment to minimize salt usage, and to track and report amounts used using the UNH Technology Transfer Center online tool (http://www.roadsalt.unh.edu/Salt/).

c. At any time during the permit term the permittee may be relieved of additional requirements in Appendix F part I.1.a-b as follows.

i. The permittee is relieved of its additional requirements as of the date when the following conditions are met:

1. The applicable TMDL has been modified or revised and EPA has approved a new TMDL applicable for the receiving water that indicates that no additional stormwater controls for the control of chloride are necessary for the permittee's discharge based on wasteload allocations in the newly approved TMDL

ii. When the criteria in Appendix F part I.1.c.i. are met, the permittee shall document the date of the approved TMDL in its SWMP and is relieved of any remaining requirements of Appendix F part I.1.a.-b as of that date and the permittee shall comply with the following:

1. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix F part.I.1.a.-b to date to reduce chloride in their discharges including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
2. The permittee shall continue to implement all requirements of Appendix F part I.a.-b required to be implemented prior to the date of the newly approved TMDL, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications,

2. The MS4 operator shall work with NHDES to develop an Alternative Chloride Reduction Plan consistent with the applicable TMDL. The MS4 operator shall submit a NHDES-approved Alternative Chloride Reduction Plan that is consistent with the TMDL Implementation Plan and includes schedules and milestones to meet applicable Waste Load Allocations, with their Notice of Intent (NOI) as an alternative to the requirements described in Appendix F part I.1. above.
    a. The Alternative Chloride Reduction Plan shall be subject to EPA review and the public comment period consistent with the NOI procedures at part 1.7.4.b. of the permit.
    b. The permittee shall keep the written plan (hardcopy or electronic) as part of their SWMP.
    c. The permittee shall implement all operator-specific permit requirements included in the permittee's authorization letter from EPA based on the Alternative Chloride Reduction Plan.
    d. Unless the operator-specific permit requirements related to the Alternative Chloride Reduction Plan are authorized by EPA, the permittee is subject to the requirements described in Appendix F part I.1. above.

II. Bacteria TMDLs

Permittees that operate regulated MS4s in the municipalities identified on Table F-1 that discharge to waterbodies listed on Table F-1 in Appendix F, and any other permittee that discharges to waterbodies listed on Table F-1 in Appendix F, shall reduce bacteria or pathogen discharges to support achievement of the WLA included in the approved TMDLs[2] by complying with EITHER Appendix F Part II.1 or Appendix F Part II.2 below.

1. Traditional and non-traditional MS4s operating in the municipalities listed in Table F-1 and/or that discharge to a waterbody listed on Table F-1 shall comply with the following BMPs in addition to the requirements of part 2.3 of the Permit, as described below:

    a. Enhancement of BMPs required by part 2.3 of the permit that shall be implemented during this permit term:

        i. Part 2.3.3. Public Education: The permittee shall replace its Residential program with an annual message encouraging the proper management of pet waste, including noting any existing ordinances where appropriate, at a minimum. The permittee or its agents shall disseminate educational materials to dog owners at the time of issuance or renewal of a dog license, or other appropriate time. Education materials shall describe the detrimental impacts of improper management of pet waste, requirements for waste collection and disposal, and penalties for non-compliance. The permittee shall also provide information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria or pathogens.

        ii. Part 2.3.4 Illicit Discharge: The permittee shall implement the illicit discharge program required by this permit. Catchments draining to any waterbody impaired for bacteria or pathogens shall be designated either Problem Catchments or HIGH priority in implementation of the IDDE program.

    b. At any time during the permit term the permittee may be relieved of additional requirements in Appendix F part II.1.a., as follows:

        i. The permittee is relieved of its additional requirements as of the date when the following conditions are met:

            1. The applicable TMDL has been modified or revised and EPA has approved a new TMDL applicable for the receiving water that indicates that no additional stormwater controls for the control of bacteria/pathogens are necessary for the permittee's discharge based on wasteload allocations in the newly approved TMDL

[2] Hampton/Seabrook Harbor Bacteria TMDL, May 2004, Little Harbor Bacteria TMDL, June 2006, Final Report New Hampshire Statewide TMDL for Bacteria Impaired Waters, September 2010, Final Report TMDL Report for 58 Bacteria Impaired Waters in New Hampshire, August2011, Final TMDL Report for 44 Bacteria Impaired Waters in New Hampshire, September 2013, Final TMDL Report for 3 Bacteria Impaired Waters in New Hampshire, September 2015, Bacteria TMDL Report for Camp Hadar Beach on Captain Pond in Salem, NH, September 2016

ii. When the criteria in Appendix F Part II.1.b.i. are met, the permittee shall document the date of the approved TMDL in its SWMP and is relieved of any remaining requirements of Appendix F Part II.1.a. as of that date and the permittee shall comply with the following:
   1. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix F Part II.1.a. to date to reduce bacteria/pathogen in their discharges including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
   2. The permittee shall continue to implement all requirements of Appendix F Part II.1.a. required to be implemented prior to the date of the newly approved TMDL, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications

2. The MS4 operator shall work with NHDES to develop an Alternative Bacteria/Pathogens Reduction Plan consistent with the applicable TMDL. The MS4 operator shall submit a NHDES-approved Alternative Bacteria/Pathogens Reduction Plan that is consistent with the TMDL Implementation Plan and includes schedules and milestones to meet applicable Waste Load Allocations, with their Notice of Intent (NOI) as an alternative to the requirements described in Appendix F Part II.1. above.

a. The Alternative Bacteria/Pathogens Reduction Plan shall be subject to EPA review and the public comment period consistent with the NOI procedures at Part 1.7.4.b. of the permit.
b. The permittee shall keep the written plan (hardcopy or electronic) as part of their SWMP.
c. The permittee shall implement all operator-specific permit requirements included in the permittee's authorization letter from EPA based on the Alternative Bacteria/Pathogens Reduction Plan.
d. Unless the operator-specific permit requirements related to the Alternative Bacteria/Pathogens Reduction Plan are authorized by EPA, the permittee is subject to the requirements described in Appendix F Part II.1. above.

Table F-1 – Waterbodies and Primary Municipalities subject to a Bacteria TMDL.

Towns	Waterbody Name	Assessment Unit #	Impairment
ALLENSTOWN	CATAMOUNT POND - BEAR BROOK STATE PARK BEACH	NHLAK700060503-02-02	Escherichia coli
AMHERST	BABOOSIC LAKE - TOWN BEACH	NHLAK700060905-01-02	Escherichia coli
AMHERST; MILFORD	SOUHEGAN RIVER	NHRIV700060906-16	Escherichia coli
AMHERST; MERRIMACK	BABOOSIC LAKE	NHLAK700060905-01-01	Escherichia coli
BEDFORD	PATTEN BROOK	NHRIV700060803-12	Escherichia coli
BEDFORD	MCQUADE BROOK	NHRIV700060905-13	Escherichia coli

Towns	Waterbody Name	Assessment Unit #	Impairment
GOFFSTOWN; BEDFORD	RIDDLE BROOK	NHRIV700060905-18	Escherichia coli
DERRY	ISLAND POND - CHASE'S GROVE	NHLAK700061101-01-02	Escherichia coli
DERRY	BEAVER LAKE - GALLIEN'S BEACH	NHLAK700061203-02-02	Escherichia coli
DERRY	HOODS POND - TOWN BEACH	NHLAK700061203-03-02	Escherichia coli
DERRY	RAINBOW LAKE - KAREN-GENA BEACH	NHLAK700061203-05-02	Escherichia coli
DERRY	BEAVER BROOK	NHRIV700061203-09	Escherichia coli
DERRY	TAYLOR BROOK	NHRIV700061101-05	Escherichia coli
DOVER; ROLLINSFORD	SALMON FALLS RIVER	NHEST600030406-01	Enterococcus
DOVER; ROLLINSFORD	SALMON FALLS RIVER	NHEST600030406-01	Fecal coliform
DOVER	COCHECO RIVER	NHEST600030608-01	Enterococcus
DOVER	COCHECO RIVER	NHEST600030608-01	Fecal coliform
DOVER	DOVER WWTF SZ-NH	NHEST600031001-01-02	Enterococcus
DOVER	COCHECO RIVER - CENTRAL AVE DAM	NHIMP600030608-04	Escherichia coli
DOVER	BELLAMY RIVER - SAWYERS MILL DAM POND	NHIMP600030903-02	Escherichia coli
DOVER; ROLLINSFORD	FRESH CREEK POND	NHLAK600030608-01	Escherichia coli
ROCHESTER; SOMERSWORTH; DOVER	BLACKWATER BROOK-CLARK BROOK	NHRIV600030608-02	Escherichia coli
ROCHESTER; DOVER	COCHECO RIVER	NHRIV600030608-03	Escherichia coli
DOVER	REYNERS BROOK	NHRIV600030608-04	Escherichia coli
DOVER	COCHECO RIVER	NHRIV600030608-05	Escherichia coli
DOVER	INDIAN BROOK	NHRIV600030608-06	Escherichia coli
DOVER	BERRY BROOK	NHRIV600030608-15	Escherichia coli
DOVER	JACKSON BROOK	NHRIV600030608-16	Escherichia coli
DOVER	BELLAMY RIVER	NHRIV600030903-09	Escherichia coli
DOVER	VARNEY BROOK - CANNEY BROOK	NHRIV600030903-11	Escherichia coli
DOVER	GARRISON BROOK	NHRIV600030903-13	Escherichia coli
DOVER	BELLAMY RIVER NORTH	NHEST600030903-01-01	Fecal Coliform

Towns	Waterbody Name	Assessment Unit #	Impairment
DOVER	UPPER PISCATAQUA RIVER-NH-NORTH	NHEST600031001-01-01	Fecal coliform
DOVER	UPPER PISCATAQUA RIVER-NH-SOUTH	NHEST600031001-01-03	Fecal coliform
DOVER	BELLAMY RIVER SOUTH1	NHEST600030903-01-02	Enterococcus/Fecal Coliform
DOVER	COCHECO RIVER - WATSON-WALDRON DAM POND	NHIMP600030608-02	Escherichia coli
DURHAM	OYSTER RIVER	NHEST600030902-01-03	Enterococcus
DURHAM	ADAMS POINT SOUTH - COND APP1	NHEST600030904-04-06	Enterococcus/Fecal Coliform
DURHAM	OYSTER RIVER	NHIMP600030902-04	Escherichia coli
DURHAM	BEARDS CREEK	NHIMP600030902-06	Escherichia coli
DURHAM	OYSTER RIVER	NHRIV600030902-05	Escherichia coli
DURHAM	LONGMARSH BROOK - BEAUDETTE BROOK	NHRIV600030902-06	Escherichia coli
DURHAM	HAMEL BROOK	NHRIV600030902-08	Escherichia coli
DURHAM	COLLEGE BROOK	NHRIV600030902-09	Escherichia coli
DURHAM	RESERVOIR BROOK	NHRIV600030902-10	Escherichia coli
DURHAM	LITTLEHOLE CREEK	NHRIV600030902-11	E coli
DURHAM	CROMMENT CREEK	NHEST600030904-04-02	Fecal Coliform
DURHAM	ADAMS POINT TRIB	NHEST600030904-06-11	Fecal Coliform
DURHAM	OYSTER RIVER MOUTH	NHEST600030904-06-17	Fecal Coliform
EXETER	EXETER RIVER - EXETER RIVER DAM I	NHIMP600030805-04	Escherichia coli
EXETER	EXETER RIVER	NHRIV600030805-02	Escherichia coli
EXETER	NORRIS BROOK	NHRIV600030806-01	Escherichia coli
GOFFSTOWN; MANCHESTER	NAMASKE LAKE	NHLAK700060607-02	Escherichia coli
GOFFSTOWN	HARRY BROOK	NHRIV700060607-15	Escherichia coli
GOFFSTOWN	CATAMOUNT BROOK	NHRIV700060607-20	Escherichia coli
GOFFSTOWN	GLEN LAKE - PUBLIC (STATE OWNED) BEACH	NHLAK700060607-01-02	Escherichia coli
GREENLAND	UNKNOWN RIVER - WINNICUT RIVER DAM POND	NHIMP600030901-02	Escherichia coli
GREENLAND	HAINES BROOK	NHRIV600030901-03	Escherichia coli
GREENLAND	NORTON BROOK	NHRIV600030901-06	E coli
GREENLAND	FOSS BROOK	NHRIV600030904-05	E coli

Towns	Waterbody Name	Assessment Unit #	Impairment
GREENLAND	SHAW BROOK	NHRIV600030904-13	Escherichia coli
GREENLAND	UNNAMED BROOK	NHRIV600030904-21	Escherichia coli
GREENLAND	WINNICUT RIVER	NHEST600030904-01	Fecal coliform
GREENLAND; STRATHAM; NORTH HAMPTON	WINNICUT RIVER-BARTON BROOK-MARSH BROOK-THOMPSON BROOK	NHRIV600030901-02	Escherichia coli
HAMPSTEAD	WASH POND - TOWN BEACH	NHLAK700061101-03-02	Escherichia coli
HAMPSTEAD	SUNSET LAKE - SUNSET PARK BEACH	NHLAK700061101-03-03	Escherichia coli
HAMPTON	HAMPTON RIVER MARINA SZ	NHEST600031004-09-08	Enterococcus
HAMPTON	ATLANTIC OCEAN - HAMPTON BEACH STATE PARK BEACH	NHOCN000000000-02-10	Enterococcus
HAMPTON	TAYLOR RIVER	NHEST600031003-03	Fecal Coliform
HAMPTON	HAMPTON FALLS RIVER	NHEST600031004-01-03	Fecal Coliform
HAMPTON	TAYLOR RIVER (LOWER)	NHEST600031004-02-02	Fecal Coliform
HAMPTON	HAMPTON RIVER 2, R, 65.60, AC	NHEST600031004-04-02	Enterococcus
HAMPTON; SEABROOK	HAMPTON HARBOR SEG. 04-03	NHEST600031004-04-03	Fecal Coliform
HAMPTON; SEABROOK	HAMPTON HARBOR SEG. 09-01	NHEST600031004-09-01	Fecal Coliform
HAMPTON	HAMPTON/SEABROOK HARBOR 02	NHEST600031004-09-02	
HOLLIS	SILVER LAKE - STATE PARK BEACH	NHLAK700061001-02-02	Escherichia coli
AMHERST; MILFORD; HOLLIS	WITCHES BROOK	NHRIV700061001-02	Escherichia coli
HOLLIS	FLINTS BROOK,	NHRIV700040402-03	Escherichia coli
HOOKSETT	MESSER BROOK	NHRIV700060802-09	E coli
HOOKSETT; MANCHESTER	MERRIMACK RIVER	NHRIV700060802-14-02	Escherichia coli
HUDSON	ROBINSON POND	NHLAK700061203-06-01	Escherichia coli
HUDSON	ROBINSON POND - TOWN BEACH	NHLAK700061203-06-02	Escherichia coli
HUDSON	LAUNCH BROOK	NHRIV700061203-26	Escherichia coli

Towns	Waterbody Name	Assessment Unit #	Impairment
KINGSTON	COUNTRY POND - LONE TREE SCOUT RESV. BEACH	NHLAK700061403-03-03	Escherichia coli
KINGSTON	GREAT POND - KINGSTON STATE PARK BEACH	NHLAK700061403-06-02	Escherichia coli
KINGSTON	GREAT POND - CAMP BLUE TRIANGLE BEACH	NHLAK700061403-06-03	Escherichia coli
KINGSTON	Park Association Beach, Great Pond	NHLAK700061403-06-05	Escherichia coli
MANCHESTER	MERRIMACK RIVER - AMOSKEAG DAM	NHIMP700060802-04	Escherichia coli
MANCHESTER	CRYSTAL LAKE-TOWN BEACH	NHLAK700060703-02-02	Escherichia coli
GOFFSTOWN; MANCHESTER	UNNAMED BROOK - TO PISCATAQUOG RIVER	NHRIV700060607-35	E coli
MANCHESTER; AUBURN; LONDONDERRY	COHAS BROOK - LONG POND BROOK	NHRIV700060703-05	Escherichia coli
MANCHESTER	UNNAMED BROOK - FROM PINE ISLAND POND TO MERRIMACK RIVER	NHRIV700060703-09	Escherichia coli
MANCHESTER	RAYS BROOK	NHRIV700060802-15	E coli
MANCHESTER; BEDFORD	MERRIMACK RIVER	NHRIV700060803-14-02	Escherichia coli
MERRIMACK	NATICOOK LAKE - WASSERMAN PARK BEACH	NHLAK700061002-04-02	Escherichia coli
MANCHESTER; BEDFORD; MERRIMACK; LITCHFIELD	MERRIMACK RIVER	NHRIV700060804-11	Escherichia coli
AMHERST; MERRIMACK	SOUHEGAN RIVER	NHRIV700060906-18	Escherichia coli
AMHERST; MERRIMACK; NASHUA; HOLLIS	PENNICHUCK BROOK - WITCHES BROOK	NHRIV700061001-07	Escherichia coli
MERRIMACK; LITCHFIELD	MERRIMACK RIVER	NHRIV700061002-13	Escherichia coli
MERRIMACK	SOUHEGAN RIVER	NHRIV700060906-25	Escherichia coli
MILFORD	SOUHEGAN RIVER - MCLANE DAM	NHIMP700060906-08	Escherichia coli

Towns	Waterbody Name	Assessment Unit #	Impairment
MILFORD	PURGATORY BROOK	NHRIV700060904-07	Escherichia coli
WILTON; MILFORD	SOUHEGAN RIVER	NHRIV700060904-14	Escherichia coli
MILFORD	GREAT BROOK - OX BROOK	NHRIV700060906-12	Escherichia coli
MILFORD	SOUHEGAN RIVER	NHRIV700060906-13	Escherichia coli
MILTON	MILTON POND - MILTON POND REC AREA BEACH	NHLAK600030404-01-03	Escherichia coli
MILTON	DAMES BROOK	NHRIV600030601-07	Escherichia coli
MILTON	JONES BROOK	NHRIV600030402-04	Escherichia coli
NASHUA	NASHUA RIVER - NASHUA CANAL DIKE	NHIMP700040402-03	E coli
NASHUA	NASHUA RIVER - JACKSON PLANT DAM POND	NHIMP700040402-05	Escherichia coli
NASHUA	NASHUA RIVER	NHRIV700040402-08	Escherichia coli
NASHUA	NASHUA RIVER	NHRIV700040402-09	Escherichia coli
MERRIMACK; LITCHFIELD; HUDSON; NASHUA	MERRIMACK RIVER	NHRIV700061002-14	Escherichia coli
NASHUA	SALMON BROOK - HASSELLS BROOK - OLD MAIDS BROOK - HALE BROOK	NHRIV700061201-05	Escherichia coli
NASHUA	SALMON BROOK	NHRIV700061201-07	Escherichia coli
HUDSON; NASHUA	MERRIMACK RIVER	NHRIV700061206-24	Escherichia coli
NEW CASTLE	ATLANTIC OCEAN - NEW CASTLE BEACH	NHOCN000000000-02-02	Enterococcus
NEWMARKET; GREENLAND; STRATHAM	GREAT BAY PROHIB SZ1	NHEST600030904-02	Enterococcus
NEWMARKET	LAMPREY RIVER	NHEST600030709-01	Enterococcus
NORTH HAMPTON; HAMPTON	LITTLE RIVER	NHEST600031004-10	Fecal coliform
NORTH HAMPTON	ATLANTIC OCEAN - STATE BEACH1	NHOCN000000000-02-09	Enterococcus/Fecal Coliform
NORTH HAMPTON	CHAPEL BROOK	NHEST600031002-03	Fecal coliform
NORTH HAMPTON	TRIBUTARY TO CHAPEL BROOK	NHRIV600031002-23	Escherichia coli

Towns	Waterbody Name	Assessment Unit #	Impairment
NORTH HAMPTON	CHAPEL BROOK	NHRIV600031002-24	Escherichia coli
PELHAM	LONG POND - TOWN BEACH	NHLAK700061205-02-02	Escherichia coli
WINDHAM; HUDSON; PELHAM	BEAVER BROOK	NHRIV700061203-22	Escherichia coli
PELHAM	BEAVER BROOK - TONYS BROOK	NHRIV700061205-01	Escherichia coli
HAMPSTEAD; PLAISTOW; ATKINSON	KELLY BROOK - SEAVER BROOK	NHRIV700061401-04	Escherichia coli
PORTSMOUTH; NEW CASTLE	LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	Enterococcus
PORTSMOUTH	UPPER SAGAMORE CREEK	NHEST600031001-03	Fecal coliform
PORTSMOUTH	UPPER SAGAMORE CREEK	NHEST600031001-03	Enterococcus
PORTSMOUTH; NEW CASTLE; RYE	LOWER SAGAMORE CREEK	NHEST600031001-04	Enterococcus
PORTSMOUTH	SOUTH MILL POND	NHEST600031001-09	Enterococcus
PORTSMOUTH	NORTH MILL POND	NHEST600031001-10	Enterococcus
PORTSMOUTH; GREENLAND	PICKERING BROOK	NHRIV600030904-06	Escherichia coli
PORTSMOUTH	SAGAMORE CREEK	NHRIV600031001-03	Escherichia coli
PORTSMOUTH	LOWER HODGSON BROOK	NHRIV600031001-04	Escherichia coli
PORTSMOUTH	UPPER HODGSON BROOK	NHRIV600031001-05	Escherichia coli
PORTSMOUTH	PAULS BROOK - PEASE AIR FORCE BASE	NHRIV600031001-07	Escherichia coli
PORTSMOUTH	BORTHWICK AVE TRIBUTARY	NHRIV600031001-09	Escherichia coli
PORTSMOUTH	NEWFIELDS DITCH	NHRIV600031001-10	Escherichia coli
RAYMOND	LAMPREY RIVER - CARROLL LAKE BEACH	NHRIV600030703-07-02	Escherichia coli
ROCHESTER	SALMON FALLS RIVER - BAXTER MILL DAM POND	NHIMP600030405-04	Escherichia coli
ROCHESTER	COCHECO RIVER - GONIC DAM POND	NHIMP600030607-02	Escherichia coli
ROCHESTER	COCHECO RIVER	NHRIV600030603-06	Escherichia coli

Towns	Waterbody Name	Assessment Unit #	Impairment
ROCHESTER	COCHECO RIVER	NHRIV600030603-08	Escherichia coli
ROCHESTER	WILLOW BROOK	NHRIV600030603-10	Escherichia coli
ROCHESTER	ISINGLASS RIVER	NHRIV600030607-10	E coli
ROCHESTER	COCHECO RIVER - CITY DAM 1	NHIMP600030603-01	Escherichia coli
ROCHESTER	COCHECO RIVER - HATFIELD	NHIMP600030603-02	Escherichia coli
ROCHESTER	AXE HANDLE BROOK - HOWARD BROOK	NHRIV600030602-03	Escherichia coli
ROLLINSFORD	SALMON FALLS RIVER - SOUTH BERWICK DAM	NHIMP600030406-04	Escherichia coli
SOMERSWORTH; ROLLINSFORD	FRESH CREEK - TWOMBLY BROOK	NHRIV600030608-08	Escherichia coli
ROLLINSFORD	ROLLINS BROOK	NHRIV600030608-10	Escherichia coli
DOVER; ROLLINSFORD	FRESH CREEK	NHRIV600030608-11	Escherichia coli
RYE	WITCH CREEK1	NHEST600031002-01-01	Enterococcus/Fecal Coliform
RYE	BERRYS BROOK1	NHEST600031002-01-02	Enterococcus/Fecal Coliform
NEW CASTLE; RYE	LITTLE HARBOR	NHEST600031002-02	Total Fecal; Enterococcus
RYE	PARSONS CREEK	NHEST600031002-05	Fecal coliform
RYE	ATLANTIC OCEAN - PIRATES COVE BEACH	NHOCN000000000-02-04	Enterococcus
RYE	ATLANTIC OCEAN - CABLE BEACH	NHOCN000000000-02-05	Enterococcus
RYE	ATLANTIC OCEAN - SAWYER BEACH1	NHOCN000000000-02-06	Enterococcus/Fecal Coliform
RYE	ATLANTIC OCEAN - JENNESS BEACH	NHOCN000000000-02-07	Enterococcus
RYE; NORTH HAMPTON	BASS BROOK BEACH OUTFALL AREA1	NHOCN000000000-03-01	Enterococcus/Fecal Coliform
NORTH HAMPTON	ATLANTIC OCEAN - BASS BEACH1	NHOCN000000000-03-02	Enterococcus/Fecal Coliform
PORTSMOUTH; GREENLAND; RYE	BERRY'S BROOK	NHRIV600031002-01	Escherichia coli
RYE	UNNAMED BROOKS - TO ATLANTIC OCEAN AT CONCORD POINT	NHRIV600031002-03	Escherichia coli

Towns	Waterbody Name	Assessment Unit #	Impairment
RYE	UNNAMED BROOK TO BASS BEACH	NHEST600031002-04	Fecal coliform
RYE	UNNAMED BROOK - FROM EEL POND TO ATLANTIC OCEAN RYE OUTFALL	NHRIV600031002-10	Escherichia coli
SALEM	ARLINGTON MILL RESERVOIR-SECOND ST BEACH	NHLAK700061101-04-02	E coli
SALEM	CAPTAIN POND - CAPTAIN'S BEACH	NHLAK700061102-03-02	Escherichia coli
SALEM	CAPTAIN POND - CAMP OTTER SWIM AREA BEACH	NHLAK700061102-03-03	Escherichia coli
SALEM	MILLVILLE LAKE - TOWN BEACH	NHLAK700061102-06-02	E coli
SALEM	Merrimack River	NHRIV700061102-03-06	Escherichia coli
SALEM	ARLINGTON MILL RESERVOIR-ARLINGTON POND IMPROVEMENT ASSOC	NHLAK700061101-04-03	Escherichia coli
SALEM	SALEM TOWN BEACH-HEDGEHOG POND	NHLAK700061102-13	Escherichia coli
SANDOWN	EXETER RIVER	NHRIV600030802-03	Escherichia coli
SEABROOK	MILL CREEK	NHEST600031004-07	Enterococcus
SEABROOK	MILL CREEK	NHEST600031004-07	Enterococcus
SEABROOK	BLACKWATER RIVER	NHEST600031004-08-04	Enterococcus
SEABROOK	SEABROOK HARBOR BEACH	NHEST600031004-09-05	Enterococcus
SEABROOK	ATLANTIC OCEAN - SEABROOK TOWN BEACH	NHOCN000000000-02-11	Enterococcus
SEABROOK	CAINS BROOK - NOYES POND	NHIMP600031004-06	E coli
SEABROOK	CAIN'S BROOK	NHRIV600031004-10	Escherichia coli
SEABROOK	CAIN'S BROOK	NHRIV600031004-12	Escherichia coli
SEABROOK	UNNAMED BROOK TO CAINS MILL POND	NHRIV600031004-21	E coli
SEABROOK	Hunts Island Creek, P/Uc, 15.99, Ac	NHEST600031004-06	Fecal Coliform
SEABROOK	BLACKWATER RIVER 1, R, 69.47, AC	NHEST600031004-08-01	Enterococcus

Towns	Waterbody Name	Assessment Unit #	Impairment
SEABROOK	BLACKWATER RIVER 2, R, 71.07, AC	NHEST600031004-08-02	Enterococcus
SOMERSWORTH	SALMON FALLS RIVER - LOWER GREAT FALLS DAM	NHIMP600030406-02	Escherichia coli
SOMERSWORTH; DOVER	WILLAND POND	NHLAK600030405-03	E coli
ROCHESTER; SOMERSWORTH	SALMON FALLS RIVER	NHRIV600030405-14	Escherichia coli
SOMERSWORTH	SALMON FALLS RIVER	NHRIV600030406-03	Escherichia coli
STRATHAM; EXETER	WHEELWRIGHT CREEK - PARKMAN BROOK	NHRIV600030806-04	Escherichia coli
STRATHAM	TRIB TO SQUAMSCOTT RIVER - STUART DAIRY FARM	NHRIV600030806-14	Escherichia coli
STRATHAM	SQUAMSCOTT RIVER	NHEST600030806-01	Enterococcus
WILTON	CAMP ANN JACKSON GIRL SCOUT POND SWIMMING AREA	NHIMP700060902-13-02	E coli
WILTON	SOUHEGAN RIVER - PINE VALLEY MILL	NHIMP700060904-08	Escherichia coli
WILTON	SOUHEGAN RIVER - TUCKER BROOK	NHRIV700060902-05	Escherichia coli
WILTON	SOUHEGAN RIVER	NHRIV700060902-13	Escherichia coli
WILTON	STONY BROOK - TOWN BEACH (GOSS PARK)	NHRIV700060903-16-02	Escherichia coli
WILTON	SOUHEGAN RIVER - STONY BROOK	NHRIV700060904-13	Escherichia coli
WINDHAM	TOWN BEACH - COBBETTS POND	NHLAK700061204-01-03	Escherichia coli

III. Lake and Pond Phosphorus TMDLs

Permittees that operate regulated MS4s in the municipalities identified on Table F-2 that discharge to waterbodies listed on Table F-2 in Appendix F or their tributaries, and any other permittee that discharges to waterbodies listed on Table F-2 in Appendix F or their tributaries, shall reduce phosphorus discharges to support achievement of the WLA included in the approved TMDLs complying with EITHER Appendix F Part III.1 or Appendix F Part III.2 below.

1. The permittee shall develop a Lake Phosphorus Control Plan (LPCP) designed to reduce the amount of phosphorus in stormwater discharges from its MS4 to the impaired waterbody or its tributaries consistent with assumptions and requirements of the WLA for the phosphorous loadings published in the applicable phosphorus TMDL (see Table F-2 for TMDL names and links to applicable phosphorus TMDLs). Table F-2, Appendix F provides the percent reductions in stormwater total phosphorus load for each municipality to be consistent with the assumptions and requirements of the WLA

Table F-2: Waterbodies and Primary Municipalities subject to a Lake or Pond Phosphorus TMDL

Towns	Water Body Name	% Reduction In TP Load for all Sources	TMDL Link
Amherst; Merrimack	Baboosic Lake	44%	Baboosic TMDL
Merrimack	Horseshoe Pond	76%	Horseshoe TMDL
Manchester	Nutt Pond	71%	Nutt TMDL
Manchester	Pine Island Pond	64%	Pine Island TMDL
Hudson	Robinson Pond	48%	Robinson TMDL
Bedford	Sebbins Pond	64%	Sebbins TMDL
Sandown	Showell Pond	69%	Showell TMDL
Manchester	Stevens Pond	50%	Stevens TMDL
Derry	Hoods Pond	76%	Hoods TMDL
Kingston	Halfmoon Pond	74%	Halfmoon TMDL
Kingston	Greenwood Pond	69%	Greenwood TMDL
Hollis	Flints Pond	40%	Flints TMDL
Manchester	Dorrs Pond	62%	Dorrs TMDL
Kingston; Newton	Country Pond	52%	Country TMDL
Raymond	Governors Lake	47%	Governors TMDL
Bedford	Sandy Pond	51%	Sandy TMDL

a. The permittee shall develop a Lake Phosphorous Control Plan (LPCP) as part of its written SWMP and update the LPCP in annual reports pursuant to Part 4.4 of the Permit. The LPCP shall describe measures the permittee will undertake to reduce the amount of phosphorous in MS4 discharges.

b. The LPCP shall be implemented in accordance with the following schedule and contain the following elements:

i. LPCP Implementation Schedule – The permittee shall complete the implementation of its LPCP as soon as possible but no later than 15 years after the effective date of the permit.

ii. The LPCP shall be implemented in accordance with the following schedule and contain the following elements:

Number	LPCP Component and Milestones	Completion Date
1	Legal Analysis	2 years after permit effective date
2	Funding source assessment	3 years after permit effective date
3	Define LPCP scope (LPCP Area)	4 years after permit effective date
4	Calculate Baseline Phosphorus, Allowable Phosphorus Load and Phosphorus Reduction Requirement	4 years after permit effective date
5	Description of planned nonstructural and structural controls	5 years after permit effective date
6	Description of Operation and Maintenance (O&M) Program	5 years after permit effective date
7	Implementation schedule	5 years after permit effective date
8	Cost and Funding Source Assessment	5 years after permit effective date
9	Complete written LPCP	5 years after permit effective date
10	Full implementation of nonstructural controls.	6 years after permit effective date
11	Performance Evaluation.	6 and 7 years after permit effective date
12	1. Performance Evaluation. 2. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) plus the applicable Phosphorus Reduction Requirement (P_{RR}) multiplied by 0.80 $P_{exp} \leq P_{allow} + (P_{RR}\ X\ 0.80)$	8 years after permit effective date
13	Performance Evaluation	9 years after permit effective date

14	1. Performance Evaluation. 2. Update LPCP 3. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) plus the applicable Phosphorus Reduction Requirement (P_{RR}) multiplied by 0.60 $P_{exp} \leq P_{allow} + (P_{RR}\ X\ 0.60)$ OR that the permittee has reduced their phosphorus export rate by 30kg/year (whichever is greater, unless full Phosphorus Reduction Requirement has been met)	10years after permit effective date
15	Performance Evaluation	11 and 12 years after permit effective date
16	1. Performance Evaluation. 2. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) plus the applicable Phosphorus Reduction Requirement (P_{RR}) multiplied by 0.30 $P_{exp} \leq P_{allow} + (P_{RR}\ X\ 0.30)$	13years after permit effective date
17	Performance Evaluation	14 years after permit effective date
18	1. Performance Evaluation. 2. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) $P_{exp} \leq P_{allow}$	15years after permit effective date

Table F-3: LPCP components and milestones

iii. Description of LPCP Components:

Legal Analysis- The permittee shall develop and implement an analysis that identifies existing regulatory mechanisms available to the MS4 such as by-laws and ordinances and describe any changes to these regulatory mechanisms that may be necessary to effectively implement the LPCP. This may include the creation or amendment of financial and regulatory authorities. The permittee shall adopt necessary regulatory changes by the end of the permit term.

Scope of the LPCP (LPCP Area) - The permittee shall indicate the area in which the permittee plans to implement the LPCP, this area is known as the "LPCP Area". The permittee must choose one of the following: 1) to implement its LPCP in the entire area within its jurisdiction discharging to the impaired waterbody (for a municipality this would be the municipal boundary) or 2) to implement its LPCP in only the urbanized area portion of its jurisdiction discharging to the impaired waterbody. If the permittee chooses to implement the LPCP in its entire jurisdiction discharging to the impaired waterbody, the permittee may demonstrate compliance with the Phosphorus Reduction Requirement and Allowable Phosphorus Load requirements applicable to it through structural and non-structural controls on discharges that occur both inside and outside the urbanized area. If the permittee chooses to implement the LPCP in its urbanized area only discharging to the impaired waterbody, the permittee must demonstrate compliance with the Phosphorus Reduction Requirement and Allowable Phosphorus Load requirements applicable to it through structural and non-structural controls on discharges that occur within the urbanized area only.

Calculate Baseline Phosphorus Load (P_{base}), Phosphorus Reduction Requirement (P_{RR}) and Allowable Phosphorus Load (P_{allow}) –Permittees shall calculate their numerical Allowable Phosphorus Load and Phosphorus Reduction Requirement in mass/yr by first estimating their Baseline Phosphorus Load in mass/yr from its LPCP Area consistent with the methodology in Attachment 1 to Appendix F or the applicable TMDL, the baseline shall only be estimated using land use phosphorus export coefficients in Attachment 1 to Appendix F or the applicable TMDL methodology and not account for phosphorus reductions resulting from implemented structural BMPs completed to date. Table F-2 contains the percent phosphorus reduction required from urban stormwater consistent with the TMDL of each impaired waterbody. The permittee shall apply the applicable required percent reduction in Table F-2 to the calculated Baseline Phosphorus Load to obtain the permittee specific Phosphorus Reduction Requirement in mass/yr. The Phosphorus Reduction Requirement load shall then be subtracted from the Baseline Phosphorus Load to obtain the permittee specific Allowable Phosphorus Load.

Description of planned non-structural controls – The permittee shall describe the non-structural stormwater control measures to be implemented to support the achievement of the milestones in Table F-3. The description of non-structural controls shall include the planned measures, the areas where the measures will be implemented, and the annual phosphorus reductions that are expected to result from their implementation. Annual phosphorus reduction from non-structural BMPs shall be calculated consistent with Attachment 2 to Appendix F. The permittee shall update the description of planned non-structural controls as needed to support the achievement of the milestones in Table F-3, including an update in the updated written LPCP 10 years after the permit effective date.

Description of planned structural controls – The permittee shall develop a priority ranking of areas and infrastructure within the municipality for potential implementation of phosphorus control practices. The ranking shall be developed through the use of available screening and monitoring results collected during the permit term either by the permittee or another entity and the mapping required pursuant to Part 2.3.4.6 of the Permit. The permittee shall also include in this prioritization a detailed assessment of site suitability for potential phosphorus control measures based on soil types and other factors. The permittee shall coordinate this activity with the requirements of Part 2.3.6.e. of the Permit. A description and the result of this priority ranking shall be included in the LPCP. The permittee shall describe the structural stormwater control measures necessary to support achievement of the milestones in Table F-3. The description of structural controls shall include the planned measures, the areas where the measures will be implemented, and the annual phosphorus reductions in units of mass/yr that are expected to result from their implementation. Structural measures to be implemented by a third party may be included in the LPCP. Annual phosphorus reduction from structural BMPs shall be calculated consistent with Attachment 3 to Appendix F. The permittee shall update the description of planned structural controls as needed to support the achievement of the milestones in Table F-3, including an update in the updated written LPCP 10 years after the permit effective date.

Description of Operation and Maintenance (O&M) Program for all planned and existing structural BMPs – The permittee shall establish an Operation and Maintenance Program for all structural BMPs being claimed for phosphorus reduction credit ~~as part the LPCP.~~ This includes BMPs implemented to date as well as BMPs to be implemented. The Operation and Maintenance Program shall become part of the LPCP and include: (1) inspection and maintenance schedule for each BMP according to BMP design or manufacturer specification and (2) program or department responsible for BMP maintenance.

Implementation Schedule – An initial schedule for implementing the BMPs, including, as appropriate: funding, training, purchasing, construction, inspections, monitoring, O&M and other assessment and evaluation components of implementation. Implementation of planned BMPs must begin upon completion of the LPCP, and all non-structural BMPs shall be fully implemented within six years of the permit effective date. Where planned structural BMP retrofits or major drainage infrastructure projects are expected to take additional time to construct, the permittee shall within four years of the effective date of the permit have a schedule for completion of construction consistent with the reduction requirements in Table F-3. The permittee shall complete the implementation of its LPCP as soon as possible or at a minimum in accordance with the milestones set forth in Table F-3. The implementation schedule shall be updated as needed to support the achievement of the milestones in Table F-3, including an update in the updated written LPCP 10 years after the permit effective date.

Cost and funding source assessment – The permittee shall estimate the cost for implementing its LPCP and describe known and anticipated funding mechanisms. The permittee shall describe the steps it will take to implement its funding plan. This may include but is not limited to conceptual development, outreach to affected parties, and development of legal authorities.

Complete written LPCP – The permittee must complete the written LPCP 5 years after permit effective date. The complete LPCP shall include item numbers 1-8 in Table F-3. The permittee shall make the LPCP available to the public for public comment during the LPCP development. EPA encourages the permittee to post the LPCP online to facilitate public involvement. The LPCP shall be updated as needed with an update 10 years after the permit effective date at a minimum to reflect changes in BMP implementation to support achievement of the phosphorus export milestones in Table F-3. The updated LPCP shall build upon the original LPCP and include additional or new BMPs the permittee will use to support the achievement of the milestones in Table F-3.

Performance Evaluation – The permittee shall evaluate the effectiveness of the LPCP by tracking the phosphorus reductions achieved through implementation of structural and non-structural BMPs[3] and tracking increases in phosphorus loading from the LPCP Area beginning six years after the effective date of the permit. Phosphorus reductions shall be calculated consistent with Attachment 2 (non-structural BMP performance), Attachment 3 (structural BMP performance) and Attachment 1 (reductions through land use change), to Appendix F for all BMPs implemented to date.[4] Phosphorus load increases resulting from development shall be calculated consistent with Attachment 1 to Appendix F. Phosphorus loading increases and reductions in units of mass/yr shall be added or subtracted from the calculated Baseline Phosphorus Load to estimate the yearly phosphorous export rate from the LPCP Area in mass/yr. The permittee shall also include all information required in Part III.1.c. of this Appendix in each performance evaluation.

Alternative Schedule Request– If the permittee determines that the schedule to meet required phosphorus reductions contained in items 12, 14, 16 or 18 in Table F-3 is impracticable, the permittee may submit to EPA an Alternative Schedule Request to meet the phosphorus reduction requirements in items 12, 14, 16 or 18 in Table F-3 on the shortest schedule that is achievable considering the factors below.[5]

[3] In meeting its phosphorus reduction requirements a permittee may quantify phosphorus reductions by actions undertaken by another entity, except where those actions are credited to another permittee identified in Appendix F Table F-2

[4] Annual phosphorus reductions from structural BMPs installed in the LPCP Area prior to the effective date of this permit shall be calculated consistent with Attachment 3 to Appendix F. Phosphorus Reduction Credit for previously installed BMPs will only be given if the Permittee demonstrates that the BMP is performing up to design specifications and certifies that the BMP is properly maintained and inspected according to manufacturer design or specifications. This certification shall be part of the annual performance evaluation during the year credit is claimed for the previously installed BMP.

[5] See part A.II.4 for information regarding the Alternative Schedule Request submittal and review process.

a. The Alternative Schedule Request shall include an analysis demonstrating that the schedule to meet phosphorus reduction requirements in items 12, 14, 16 or 18 in Table F-3 is impracticable, EPA expects that an Alternative Schedule Request to meet the phosphorus reduction requirement in item number 12 in Table F-3 would only be submitted in extraordinary circumstances and would occur rarely, where meeting the phosphorus reductions in number 12 in Table F-3 is unaffordable[6] .All Alternative Schedule Requests must include, where relevant, the following:

i. A narrative of the reasons for the permittee's request for an alternative schedule, including information demonstrating the applicant's efforts and extent of progress made toward meeting required phosphorus reductions in Table F-3,

ii. A description of the planned structural controls to meet applicable phosphorus reduction milestones,

iii. Suitability and availability of areas for siting and constructing structural controls, including, if appropriate, a review of third-party partnerships considered for within-watershed structural control sites,

iv. Access and acquisition of real property rights for constructing and maintaining structural controls,

v. Timelines for the permittee's planning, design, financing, easement or property interest acquisition, and procurement for and construction of structural controls,

vi. Timelines for and constraints due to the federal, state and/or local approval(s) and permitting processes for structural controls,

vii. Anticipated phosphorus reductions due to the rate of redevelopment within the community and the degree to which future redevelopment may be reasonably anticipated to achieve the desired reductions in lieu of reliance upon structural controls by the permittee,

viii. Estimated cost of the planned structural controls to meet applicable phosphorus reduction milestones,

ix. Scale of structural BMP controls required and phasing considerations with other capital improvement projects that are being implemented by the permittee or other parties that impact the permittee, municipality or relevant taxpayers or ratepayers,

x. Affordability for taxpayers or ratepayers (as applicable), including a projection of sources and uses of funds, taking into consideration existing or potential financial capability and funding mechanisms (e.g., property taxes, stormwater rate changes, or stormwater utility fees),

xi. Other relevant information, and

xii. A requested schedule to meet all phosphorus reduction requirements from which relief is sought.

[6] EPA notes that such expectation regarding infrequency does not constitute or establish an additional criterion for the applicant to satisfy

c. Reporting. Beginning 6 years after the permit effective date, the permittee shall include the following in each annual report submitted pursuant to Part 4.4 of the Permit:
   i. All non-structural control measures implemented during the reporting year along with the phosphorus reduction in mass/yr (P_{NSred}) calculated consistent with Attachment 2 to Appendix F
   ii. Structural controls implemented during the reporting year and all previous years including:
      1. Location information of structural BMPs (GPS coordinates or street address)
      2. Phosphorus reduction from all structural BMPs implemented to date in mass/yr (P_{Sred}) calculated consistent with Attachment 3 to Appendix F
      3. Date of last completed maintenance for each Structural control
   iii. Phosphorus load increases due to development over the previous reporting period and incurred to date (P_{DEVinc}) calculated consistent with Attachment 1 to Appendix F.
   iv. Estimated yearly phosphorus export rate (P_{exp}) from the LPCP Area calculated using Equation 1. Equation 1 calculates the yearly phosphorus export rate by subtracting yearly phosphorus reductions through implemented nonstructural controls and structural controls to date from the Baseline Phosphorus Load and adding loading increases incurred through development to date. This equation shall be used to demonstrate compliance with ~~the phosphorus reduction milestones required as part of each phase of the LPCP.~~ applicable phosphorus reduction milestones.

$$P_{exp}\left(\frac{mass}{yr}\right) = P_{base}\left(\frac{mass}{yr}\right) - \left(P_{Sred}\left(\frac{mass}{yr}\right) + P_{NSred}\left(\frac{mass}{yr}\right)\right) + P_{DEVinc}\left(\frac{mass}{yr}\right)$$

Equation 1. Equation used to calculate yearly phosphorus export rate from the chosen LPCP Area. P_{exp}=Current phosphorus export rate from the LPCP Area in mass/year. P_{base}=baseline phosphorus export rate from LPCP Area in mass/year. P_{Sred}= yearly phosphorus reduction from implemented structural controls in the LPCP Area in mass/year. P_{NSred}= yearly phosphorus reduction from implemented non-structural controls in the LPCP Area in mass/year. Area in mass/year. P_{DEVinc}= yearly phosphorus increase resulting from development since the year baseline loading was calculated in the LPCP Area in mass/year.

   v. Certification that all structural BMPs are being inspected and maintained according to the O&M program specified as part of the PCP. The certification statement shall be:

   I certify under penalty of law that all source control and treatment Best Management Practices being claimed for phosphorus reduction credit have been inspected, maintained and repaired in accordance with manufacturer or design specification. I certify that, to the best of my knowledge, all Best Management Practices being claimed for a phosphorus reduction credit are performing as originally designed.

d. At any time during the permit term the permittee may be relieved of additional requirements in Appendix F Part III.1.a - b as follows.
   i. The permittee is relieved of its additional requirements as of the date when the following conditions are met:
      1. The applicable TMDL has been modified or revised and EPA has approved a new TMDL applicable for the receiving water that indicates that no additional stormwater controls for the control of phosphorus are necessary for the permittee's discharge based on wasteload allocations in the newly approved TMDL
   ii. When the criteria in Appendix F part III.1.d.i. are met, the permittee shall document the date of the approved TMDL in its SWMP and is relieved of any remaining requirements of Appendix F part III.1.a.-b. as of that date and the permittee shall comply with the following:
      1. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix F part III.1.a.-b. to date to reduce phosphorus in their discharges including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
      2. The permittee shall continue to implement all requirements of Appendix F part III.1.a.-b. required to be implemented prior to the date of the newly approved TMDL, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications, and the reporting requirements of Appendix F part III.1.c. remain in place.

e. The permittee may be relieved of the schedules and milestones contained in Table F-3 as follows:
   i. The permittee is relieved of the applicable schedules and milestones when all the following conditions are met:
      1. The permittee has submitted an Alternative Schedule Request package to EPA.[7,8]
      2. EPA has determined the Alternative Schedule Request submittal is complete. The Alternative Schedule Request will be deemed complete 30 days from submittal, unless EPA requests additional information from the permittee.
      3. Following a 30-day public comment period on the complete Alternative Schedule Request, EPA approves the request in writing.[9] If EPA has not acted to approve, modify with permittee consent, or deny an Alternative Schedule Request within 90 days of the close of the public comment period, the Alternative Schedule Request shall be deemed approved.

[7] Alternative Schedule Request package must be made available to the public consistent with 2.3.3. of the permit.

[8] Submittal of an alternative schedule request does not relieve the permittee of noncompliance and potential enforcement for failure to comply with any permit requirements prior to the date of approval of an Alternative Schedule.

[9] EPA expects that an Alternative Schedule Request by a permittee that at the time of such request is in non-compliance with applicable Table F-3 phosphorus reduction percentages would be denied unless the permittee provides information regarding its phosphorus reduction efforts that EPA finds acceptable for this purpose.

ii. Any action by EPA approving or denying an Alternative Schedule Request is a final agency action that shall be subject to judicial review in federal district court.

iii. When the permittee meets the conditions in Appendix F part III.1.e.i, the permittee shall incorporate the approved Alternative Schedule Request and the approval date in its LPCP. An approved Alternative Schedule Request will supersede any remaining schedules and milestones in Table F-3. The permittee shall:

1. Identify in its LPCP all activities implemented to date in accordance with the requirements of Appendix F part III.1 and conducted to reduce phosphorus in its discharges pursuant to the submitted Alternative Schedule Request, including non-structural BMP planning and implementation schedules and any structural BMP maintenance requirements;
2. Continue to implement all requirements of Appendix F part III.1 required to be implemented prior to the date of Alternative Schedule Request approval, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications and
3. Continue to implement their LPCP, and the reporting requirements of Appendix F Part III.1.c remain in place

2. The MS4 operator shall work with NHDES to develop an Alternative Phosphorus Reduction Plan consistent with the applicable TMDL. The MS4 operator shall submit a NHDES-approved Alternative Phosphorus Reduction Plan that is consistent with the TMDL Implementation Plan and includes schedules and milestones to meet applicable Waste Load Allocations consistent with the schedules and milestones contained in Appendix F part III.1 above, with their Notice of Intent (NOI) as an alternative to the requirements described in Appendix F part III.1 above.

a. The Alternative Phosphorus Reduction Plan shall be subject to EPA review and the public comment period consistent with the NOI procedures at part 1.7.4.b. of the permit.
b. The permittee shall keep the written plan (hardcopy or electronic) as part of their SWMP.
c. The permittee shall implement all operator-specific permit requirements included in the permittee's authorization letter from EPA based on the Alternative Phosphorus Reduction Plan.
d. Unless the operator-specific permit requirements related to the Alternative Phosphorus Reduction Plan are authorized by EPA, the permittee is subject to the requirements described in Appendix F part III.1 above.

ATTACHMENT 3 TO APPENDIX F

Methods to Calculate Phosphorus and Nitrogen Load Reductions for Structural Stormwater Best Management Practices

List of Tables

List of Figures

Methods to Calculate Phosphorus and Nitrogen Load Reductions for Structural Stormwater Best Management Practices in the Watershed

This attachment provides methods to determine design storage volume capacities and to calculate phosphorus and nitrogen (nutrient) load reductions for the following structural Best Management Practices (structural BMPs) for a LPCP area or watershed tributary to Great Bay:

1) Infiltration Trench;
2) Surface Infiltration Practices (i.e., basins, rain gardens and bio-retention);
3) Bio-filtration Practice;
4) Gravel Wetland System;
5) Enhanced Bio-filtration with Internal Storage Reservoir (ISR);
6) Sand Filter;
7) Porous Pavement;
8) Wet Pond or wet detention basin;
9) Dry Pond or extended dry detention basin; and
10) Dry Water Quality Grass Swale with Detention.

Additionally, this attachment provides methods to design and quantify associated nutrient load reduction credits for the following four types of semi-structural BMPs

11) Impervious Area Disconnection through Storage (e.g., rain barrels, cisterns, etc.);
12) Impervious Area Disconnection;
13) Conversions of Impervious Area to Permeable Pervious Area; and
14) Soil Amendments to Enhance Permeability of Pervious Areas.

Methods and examples are provided in this Attachment to calculate phosphorus and nitrogen (nutrient) load reductions for structural BMPs for the four following purposes:

1) To determine the design volume of a structural BMP to achieve a known nutrient load reduction target when the contributing drainage area is 100% impervious;
2) To determine the nutrient load reduction for a structural BMP with a known design volume capacity when the contributing drainage area is 100% impervious;
3) To determine the design volume of a structural BMP to achieve a known nutrient load reduction target when the contributing drainage area has impervious and pervious surfaces; and
4) To determine the nutrient load reduction for a structural BMP with a known design volume capacity when the contributing drainage area has impervious and pervious surfaces.

Examples are also provided for estimating nutrient load reductions associated with the four semi-structural/non-structural BMPs.

Also, this attachment provides the methodology for calculating the annual stormwater phosphorus and/or nitrogen load that will be delivered to BMPs for treatment (BMP Load) and to be used for quantifying phosphorus and/or nitrogen load reduction credits. The methods and annual nutrient export load rates presented in this Attachment are for the purpose of calculating load reductions for various BMPs treating storm water runoff from varying site conditions (i.e., impervious or pervious surfaces) and different land uses (e.g. commercial and institutional). The estimates of annual phosphorus load and load reductions resulting from BMP implementation are intended for use by the permittee to demonstrate compliance with its Phosphorus Reduction Requirement in accordance with Appendix F to the permit. The estimates of annual nitrogen load and load reductions resulting from BMP implementation are intended for use by the permittee to track and account for nitrogen load reductions in accordance with Appendix H to the permit.

Structural BMP performance credits: For each structural BMP type identified above (BMPs 1-10), long-term cumulative performance information is provided to calculate phosphorus and nitrogen load reductions or to determine needed design storage volume capacities to achieve a specified reduction target (e.g., 65% phosphorus load reduction). The performance information is expressed as cumulative phosphorus and/or nitrogen load removed (% removed) depending on the physical storage capacity of the structural BMP (expressed as inches of runoff from impervious area) and is provided at the end of this Attachment (see Tables 3-5 through 3-25 and performance curves Figures 3-1 through 3-20). Multiple tables and performance curves are provided for the infiltration practices to represent cumulative phosphorus load reduction performance for six infiltration rates (IR), 0.17, 0.27, 0.53, 1.02, 2.41, and 8.27 inches/hour. These infiltration rates represent the saturated hydraulic conductivity of the soils. The permittee may use the performance curves provided in this attachment to interpolate phosphorus and nitrogen load removal reductions for field measured infiltration rates that are different than the infiltration rates used to develop the performance curves. Otherwise, the permittee shall use the performance curve for the IR that is nearest, but less than, the field measured rate.

The Design Storage Volume or physical storage capacity (as referred to on the x-axis of performance curves) equals the total physical storage volume of the control structure to contain water at any instant in time. Typically, this storage capacity is comprised of the surface ponding storage volume prior to overflow and subsurface storage volumes in storage units and pore spaces of coarse filter media. Table 3-5 provides the formulae to calculate physical storage capacities for the structural control types for using the performance curves.

Semi-Structural/Non-structural BMP performance credits: For each semi-structural/non-structural BMP type identified above (BMPs 11-14), long-term cumulative performance information is provided to calculate phosphorus and/or nitrogen load reductions or to determine needed design specifications to achieve a desired reduction target (e.g., 50% phosphorus load reduction). The performance information is expressed as cumulative runoff volume reduction (% removed) depending on the design specifics and actual field conditions. Cumulative percent runoff volume reduction is being used as a surrogate to estimate both the cumulative phosphorus load and nitrogen load reduction credits for these BMPs.

To represent a wide range of potential conditions for implementing these types of BMPs, numerous performance tables and curves have been developed to reflect a wide range of potential conditions and designs such as varying storage volumes (expressed in terms of varying ratios of storage volume to impervious area (0.1 to 2.0 inches)); varying ratios of impervious source area to receiving pervious area based on hydrologic soil groups (HSGs) A, B, C and D (8:1, 6:1, 4:1, 2: 1 and 1:1); and varying discharge time periods for temporary storage (1, 2 or 3 days). The credits are provided at the end of this Attachment (see Tables 3-26 through 3-33 and performance curves Figures 3-21 through 3-41).

EPA will consider phosphorus and/or nitrogen load reductions calculated using the methods provided below to be valid for the purpose of demonstrating compliance with the terms of this permit for BMPs that have not been explicitly modeled, if the desired BMP has functionality that is similar to one of the simulated BMP types. Regarding functionality, only the surface infiltration, the infiltration trench and the four semi-structural/non-structural BMP types were simulated to direct storm water runoff into the ground (i.e., infiltration). All other simulated BMPs represent practices that are not hydraulically connected to the sub-surface soils (i.e., no infiltration) and have either under-drains or impermeable liners. Following are some simple guidelines for selecting the BMP type and/or determining whether the results of any of the BMP types provided are appropriate for another BMP of interest.

Infiltration Trench is a practice that provides temporary storage of runoff using the void spaces within the soil/sand/gravel mixture that is used to backfill the trench for subsequent infiltration into the surrounding sub-soils. Performance results for the infiltration trench can be used for all subsurface infiltration practices including systems that include pipes and/or chambers that provide temporary storage. Also, the results for this BMP type can be used for bio-retention systems that rely on infiltration when the majority of the temporary storage capacity is provided in the void spaces of the soil filter media and porous pavements that allow infiltration to occur. General design specifications for infiltration trench systems are provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm).

Surface Infiltration represents a practice that provides temporary surface storage of runoff (e.g., ponding) for subsequent infiltration into the ground. Appropriate practices for use of the surface infiltration performance estimates include infiltration basins, infiltration swales (not conveyance swales), rain gardens and bio-retention systems that rely on infiltration and provide the majority of storage capacity through surface-ponding. If an infiltration system includes both surface storage through ponding and a lessor storage volume within the void spaces of a coarse filter media, then the physical storage volume capacity used to determine the long-term cumulative phosphorus removal efficiency from the infiltration basin performance curves would be equal to the sum of the surface storage volume and the void space storage volume. General design specifications for various surface infiltration systems are provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm).

Bio-filtration is a practice that provides temporary storage of runoff for filtering through an engineered soil media. The storage capacity is typically made of void spaces in the filter media and temporary ponding at the surface of the practice. Once the runoff has passed through the filter media it is collected by an under-drain pipe for discharge. The performance curve for this control practice assumes zero infiltration. If a filtration system has subsurface soils that are suitable for infiltration, then user should use the either performance curves for the infiltration trench or the infiltration basin depending on the predominance of storage volume made up by free standing storage or void space storage. Depending on the design of the filter media manufactured or packaged bio-filter systems such as tree box filters may be suitable for using the bio-filtration performance results. Design specifications for bio-filtration systems are provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm).

Gravel Wetland performance results should be used for practices that have been designed in accordance or share similar features with the design specifications for subsurface gravel wetland systems provided in the report prepared by the University of New Hampshire Stormwater Center entitled *Design and Maintenance of Subsurface Gravel Wetland Systems* and dated February 4, 2015 (https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/NHDOT_SGW_02-06-15_Final_Report.pdf).

Enhanced Bio-filtration with Internal Storage Reservoir (ISR) is a practice that provides temporary storage of runoff for filtering through an engineered soil media, augmented for enhanced phosphorus removal, followed by detention and denitrification in a subsurface internal storage reservoir (ISR) comprised of gravel. Runoff flows are routed through filter media and directed to the underlying ISR via an impermeable membrane for temporary storage. An elevated outlet control at the top of the ISR is designed to provide a retention time of at least 24 hours in the system to allow for sufficient time for denitrification and nitrogen reduction to occur prior to discharge. The design storage capacity for using the cumulative performance curves is comprised of void spaces in the filter media, temporary ponding at the surface of the practice and the void spaces in the gravel ISR. The cumulative phosphorus load reduction curve for this control is intended to be used for systems in which the filter media has been augmented with materials designed and/or known to be effective at capturing phosphorus. If the filter media is not augmented to enhance phosphorus capture, then the phosphorus performance curve for the Bio-Filter should be used for estimating phosphorus load reductions. The University of New Hampshire Stormwater Center (UNHSC) developed the design of this control practice and a design template can be found at UNHSC's website (https://www.unh.edu/unhsc/news/unhsc-innovative-bioretention-template-pollutant-reductions-great-bay-estuary-watershed).

Sand Filter performance results should be used for practices that have been designed in accordance or share similar features with the design specifications for sand filter systems provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm).

Porous Pavement performance results represent systems with an impermeable under-liner and an under-drain. *If porous pavement systems do not have an impermeable under-liner so that filtered runoff can infiltrate into sub-soils, then the performance results for an infiltration trench may be used for these systems.* Design specifications for porous pavement systems are provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm).

Extended Dry Detention Pond performance results should only be used for practices that have been designed in accordance with the design specifications for extended dry detention ponds provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm).

Water Quality Grass Swale with Detention performance results should only be used for practices that have been designed in accordance with the design specifications for a water quality swale with check dams to temporarily store the target storage volume capture provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf)

Impervious Area Hydrologic Disconnection using Storage (e.g., rain barrels, cistern, etc.) performance results are for collecting runoff volumes from impervious areas such as roof tops, providing temporary storage of runoff volume using rain barrels, cisterns or other storage containers, and discharging stored volume to adjacent permeable pervious surfaces over an extended period of time. All impervious area disconnection projects must be designed to ensure that the permeable area to receive runoff from adjacent impervious areas are of sufficient size with adequate soils to receive the runoff without causing negative impacts to adjacent down-gradient properties. Careful consideration must be given to the ratio of impervious area to the pervious area that will receive the discharge. Also, devices such as level spreaders to disperse the discharge and provide sheet flow should be employed whenever needed to increase recharge and avoid flow concentration and short circuiting through the pervious area. Soil testing is needed to classify the permeability of the receiving pervious area in terms of HSG. Such practices should be designed in accordance with the design specifications for applicable buffers (e.g., developed area buffers) provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm)

Impervious Area Hydrologic Disconnection performance results are for diverting runoff volumes from impervious areas such as roadways, parking lots and roof tops, and discharging it to adjacent vegetated permeable surfaces that are of sufficient size with adequate soils to receive the runoff without causing negative impacts to adjacent down-gradient properties. Careful consideration must be given to the ratio of impervious area to the pervious area that will receive the discharge. Also, devices such as level spreaders to disperse the discharge and provide sheet flow should be employed whenever needed to increase recharge and avoid flow concentration and short circuiting through the pervious area. Soil testing is needed to classify the permeability of the receiving pervious area in terms of HSG. Such practices should be designed in accordance with the design specifications for applicable buffers (e.g., developed area buffers) provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm)

Conversion of Impervious Area to Permeable Pervious Area nutrient load reduction credits are for replacing existing impervious surfaces (such as traditional pavements and buildings with roof tops) with permeable surfaces. To be eligible for credit, it is essential that the area previously covered with impervious surface be restored to provide natural or enhanced hydrologic functioning so that the surface is permeable. Sub-soils beneath pavements are typically highly compacted and will require reworking to loosen the soil and the possible addition of soil amendments to restore permeability. Soil testing is needed to classify the permeability (in terms of HSG) of the restored pervious area.

Soil Amendments to Increase Permeability of Pervious Areas performance results are for the practice of improving the permeability of pervious areas through incorporation of soil amendments, tilling and establishing dense vegetation. This practice may be used to compliment other practices such as impervious area disconnection to improve overall performance and increase reduction credits earned. Soil testing is needed to classify the permeability (in terms of HSG) of the restored pervious area.

Alternative Methods:

A permittee may propose alternative long-term cumulative performance information or alternative methods to calculate phosphorus and/or nitrogen load reductions for the structural BMPs identified above or for other structural BMPs not identified in this Attachment.

EPA will consider alternative long-term cumulative performance information and alternative methods to calculate phosphorus and/or nitrogen load reductions for structural BMPs provided that the permittee provides EPA with adequate supporting documentation. At a minimum, the supporting documentation shall include:

1. Results of continuous BMP model simulations representing the structural BMP, using a verified BMP model and representative long-term (i.e., 10 years) climatic data including hourly rainfall data;
2. Supporting calculations and model documentation that justify use of the model, model input parameters, and the resulting cumulative phosphorus and/or nitrogen load reduction estimates;
3. If pollutant removal performance data are available for the specific BMP, model calibration results should be provided; and
4. Identification of references and sources of information that support the use of the alternative information and method.

If EPA determines that the long-term cumulative phosphorus and/or nitrogen load reductions developed based on alternative information are not adequately supported, EPA will notify the permittee in writing, and the permittee may receive no phosphorus reduction credit other than a reduction credit calculated by the permittee using the default phosphorus and/or nitrogen reduction factors provided in this Attachment for the identified practices. The permittee is required to submit to EPA valid phosphorus load reductions for structural BMPs in the LPCP area in accordance with the submission schedule requirements specified in the permit and Appendix F.

Method to Calculate Annual Phosphorus and/or Nitrogen Load Delivered to BMPs (BMP Load)

The **BMP Load** is the annual phosphorus and/or nitrogen load from the drainage area to each proposed or existing BMP used by permittee to claim credit against its stormwater phosphorus load reduction requirement (i.e., Phosphorus Reduction Requirement) or for tracking and accounting for nitrogen load reductions in the Great Bay watershed. The BMP Load is the starting point from which the permittee calculates the reduction in phosphorus load achieved by each existing and proposed BMP.

Examples are provided to illustrate use of the methods. Tables 3-1 and 3-2 below provide annual nutrient load export rates by land use category for impervious and pervious areas for phosphorus (PLERs) and nitrogen (NLER), respectively. The examples are applicable for both phosphorus and nitrogen. The permittee shall select the land use categories that most closely represents the actual uses of the drainage areas tributary to BMP. For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value. If the HSG is not known, assume HSG C conditions for the phosphorus and/or nitrogen load export rate. For drainage areas with institutional type uses, such as government properties, hospitals, and schools, the permittee shall use the commercial/industrial land use category to calculate phosphorus and/or nitrogen loads. Table 3-3 provides a crosswalk table of nutrient load export rate (PLER and NLER) land use categories in Tables 3-1 and 3-2, and the corresponding land use category codes used in NH GRANIT.

Table 3-1: Average annual distinct phosphorus (P) load export rates for use in estimating P load reduction credits in the NH MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs./acre/year	P Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (OPEN)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5

*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops, actively managed hay fields, and pasture lands. Institutional land uses, such as government properties, hospitals and schools, are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 3-2: Average annual distinct nitrogen (N) load export rates for use in estimating N load reduction credits in the NH MS4 Permit

Nitrogen Source Category by Land Use	Land Surface Cover	N Load Export Rate, lbs./acre/year	N Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	15.0	16.9
	Pervious	See* DevPERV	See* DevPERV
All Residential	Directly connected impervious	14.1	15.8
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	10.5	11.8
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	11.3	12.7
	Pervious	0.5	0.6
Open Land (OPEN)	Directly connected impervious	11.3	12.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	11.3	12.7
	Pervious	2.6	2.9
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.3	0.3
*Developed Land Pervious (DevPERV) – HSG B	Pervious	1.2	1.3
*Developed Land Pervious (DevPERV) – HSG C	Pervious	2.4	2.7
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	3.1	3.5
*Developed Land Pervious (DevPERV) – HSG D	Pervious	3.6	4.1

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the nitrogen load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for calculating nitrogen loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 3-3. Crosswalk of land use groups for NH MS4 P Load calculations to land use codes in NH GRANIT

Description of Land Use (LU) Groups for Calculating P Load Using PLERs	NH GRANIT LU Category Codes [1]
Commercial	1210-1290, 1442, 1446, 1520-30, 1590, 1610-90, and 1790
Industrial,	1300, 1370, 1410-20, 1460-80, 1510, and 1580
High Density Residential	1110, 1120 and 1140
Medium Density Residential	1130 and 1150
Low Density Residential	1190
Highway/Freeway	1440-45, 1447-50 and 1490
Forest	3000, 4000, and 6000
Open Land	1710-90, 1800
Agriculture	2000 and 2900

[1]NH GRANIT land use categories can be found at the following link (See Table 1, page 4): http://www.granit.unh.edu/resourcelibrary/GRANITresources/standards/LUStandards-I93-061107.pdf

BMP Load: To estimate the annual phosphorus and/or nitrogen load reduction for a given stormwater BMP, it is first necessary to estimate the amount of annual stormwater phosphorus and/or nitrogen load that will be directed to the BMP (BMP Load).

For a given BMP:

1) Determine the total drainage area to the BMP;

2) Distribute the total drainage area into impervious and pervious subareas by land use category as defined by Tables 3-1, 3-2 and 3-3;

3) Calculate the nutrient load for each land use-based impervious and pervious subarea by multiplying the subarea by the appropriate nutrient load export rate (i.e., PLER or NLER) provided in Tables 3-1 and 3-2; and

4) Determine the total annual phosphorus and/or nitrogen loads to the BMP by summing the calculated impervious and pervious subarea phosphorus and/or nitrogen loads.

Example 3-1 to determine phosphorus and nitrogen loads to a proposed BMP: A permittee is proposing a surface stormwater infiltration system that will treat runoff from an industrial site within the LPCP area that has a total drainage area of 12.87 acres comprised of 10.13 acres of impervious cover (e.g., roadways, parking areas and rooftops), 1.85 acres of landscaped pervious area and 0.89 acres of wooded area both with HSG C soils. The drainage area information for the proposed BMP is:

BMP Subarea ID	Land Use Category	Cover Type	Area (acres)	PLER (lb/acre/yr)*	NLER (lb/acre/yr)**
1	Industrial	impervious	10.13	1.78	15.0
2	Landscaped (HSG C)	pervious	1.85	0.21	2.4
3	Forest (HSG C)	pervious	0.89	0.12	0.5

*From Table 3-1
**From Table 3-2

The phosphorus load to the proposed BMP (BMP Load $_P$) is calculated as:

BMP Load $_P$ $= (IA_{Ind} \times PLER_{Ind}) + (PA_{Ind} \times PLER_{Ind}) + (PA_{FOREST} \times PLER_{For})$

$= (10.13 \times 1.78) + (1.85 \times 0.21) + (0.89 \times 0.12)$

= 18.53 lbs P/year

The nitrogen load to the proposed BMP (BMP Load $_N$) is calculated as:

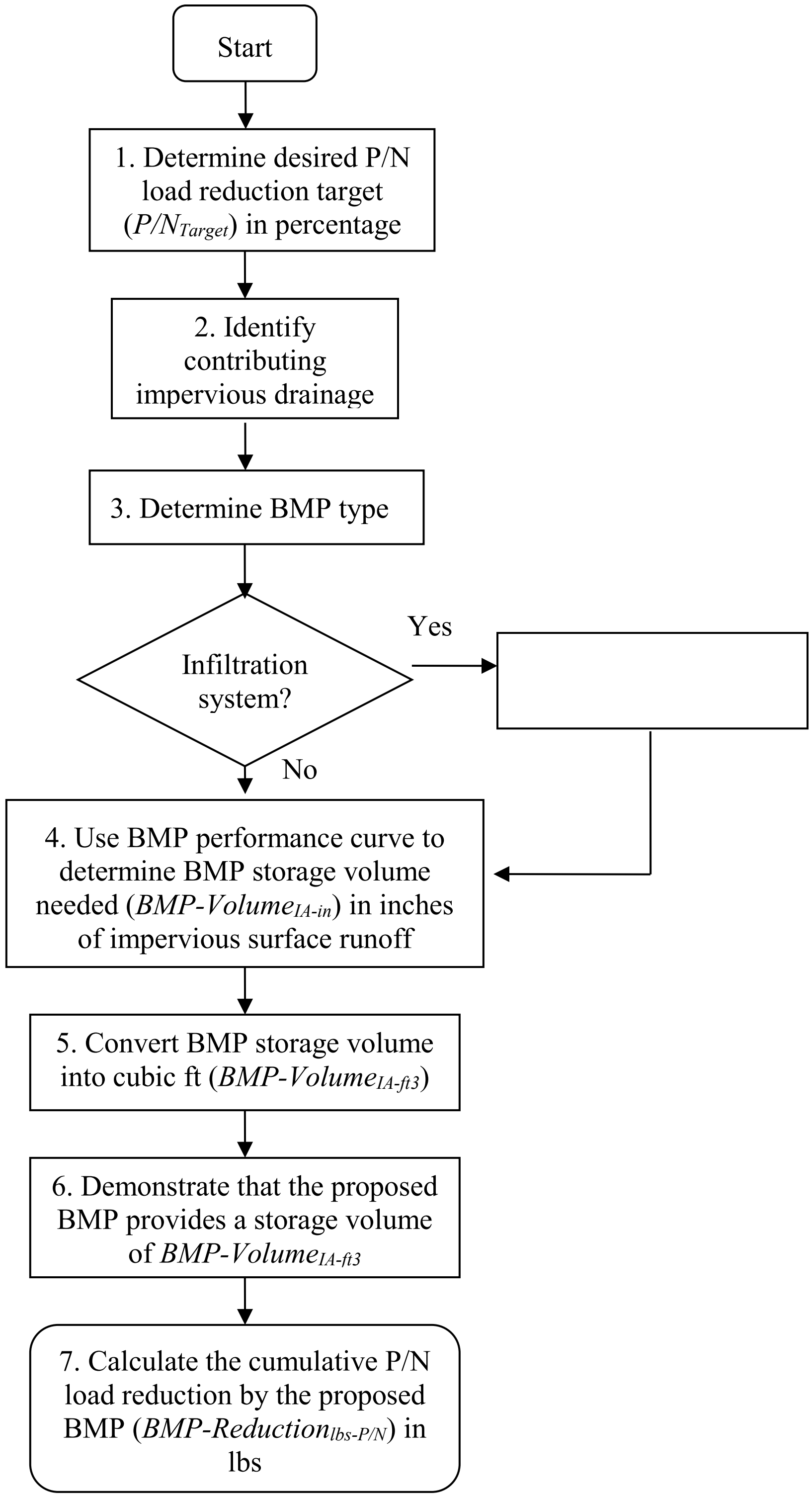
BMP Load $_N$ $= (IA_{Ind} \times NLER_{Ind}) + (PA_{Ind} \times NLER_{Ind}) + (PA_{FOREST} \times NLER_{For})$

$= (10.13 \times 15.0) + (1.85 \times 2.4) + (0.89 \times 0.5)$

= 156.9 lbs N/year

(1) Method to determine the design volume of a structural BMP to achieve a known phosphorus and/or nitrogen (P/N) load reduction target when the contributing drainage area is 100% impervious:

Flow Chart 1 illustrates the steps to determine the design volume of a structural BMP to achieve a known phosphorus and/or nitrogen (P/N) load reduction target when the contributing drainage area is 100% impervious.



Flow Chart 1: Method to determine BMP design volume to achieve a known phosphorous load reduction when contributing drainage area is 100% impervious.

1) Determine the desired cumulative phosphorus and/or nitrogen load reduction target (P/N_{target}) in percentage for the structural BMP;

2) Determine the contributing impervious drainage area (IA) in acres to the structural BMP;

3) Determine the structural BMP type (e.g., infiltration trench, gravel wetland). For infiltration systems, determine the appropriate infiltration rate for the location of the BMP in the Watershed;

4) Using the cumulative phosphorus and/or nitrogen removal performance curves for the selected structural BMP (Figures 3-1 through 3-20), determine the storage volume for the BMP ($\text{BMP-Volume}_{IA\text{-}in}$), in inches of runoff, needed to treat runoff from the contributing IA to achieve the reduction target;

5) Calculate the corresponding BMP storage volume in cubic feet ($\text{BMP-Volume}_{IA\text{-}ft^3}$) using $\text{BMP-Volume}_{IA\text{-}in}$ determined from step 4 and equation 3-1:

$$\text{BMP-Volume}_{IA\text{-}ft^3} = \text{IA (acre)} \times \text{BMP-Volume}_{IA\text{-}in} \times 3630\ ft^3/\text{ac-in}$$ **(Equation 3-1)**

6) Provide supporting calculations using the dimensions and specifications of the proposed structural BMP showing that the necessary storage volume capacity, $\text{BMP-Volume}_{IA\text{-}ft^3}$, determined from step 5 will be provided to achieve the P/N_{Target}; and

7) Calculate the cumulative P/N load reduction in pounds of P/N ($\text{BMP-Reduction}_{lbs\text{-}P/N}$) for the structural BMP using the BMP Load (as calculated from the procedure in Attachment 1 to Appendix F) and P/N_{target} by using equation 3-2:

$$\text{BMP-Reduction}_{lbs\text{-}P} = \text{BMP Load} \times (P/N_{target}/100)$$ **(Equation 3-2)**

Example 3-2 to determine design storage volume capacity of a structural BMP for a 100% impervious drainage area to achieve a known phosphorus load reduction target*:
*Note: The approach used in this example is for phosphorus and is equally applicable for nitrogen.

A permittee is considering a surface infiltration practice to capture and treat runoff from 2.57 acres (1.04 ha) of commercial impervious area in the LPCP area that will achieve a 70% reduction in average annual phosphorus load. The infiltration practice would be located adjacent to the impervious area. The permittee has measured an infiltration rate (IR) of 0.39 inches per hour (in/hr) in the vicinity of the proposed infiltration practice. Determine the:

A) Design storage volume needed for an surface infiltration practice to achieve a 70% reduction in annual phosphorus load from the contributing drainage area ($\text{BMP-Volume}_{IA\text{-}ft^3}$); and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the BMP ($\text{BMP-Reduction}_{lbs\text{-}P}$)

<u>Solution:</u>

1) Phosphorus load reduction target (P_{target}) = 70%

Solution continued:

2) Contributing impervious drainages area (IA) = 2.57 acres;

3) BMP type is a surface infiltration practice (i.e., basin) with an infiltration rate (IRBMP type is a surface infiltration practice (i.e., basin) with an infiltration rate (IR) of 0.39 in/hr

4) The performance curve for the infiltration basin (i.e., surface infiltration practice), Figure 3-8, IR = 0.27 in/hr is used to determine the design storage volume of the BMP (BMP-Volume $_{IA\text{-}in}$) needed to treat runoff from the contributing IA and achieve a P $_{target}$ = 70%. The curve for an infiltration rate of 0.27 in/hr is chosen because 0.27 in/hr is the nearest simulated IR that is less than the field measured IR of 0.39 in/hr. From Figure 3-8, the BMP-Volume $_{IA\text{-}in}$ for a P $_{target}$ = 70% is 0.36 in.

5) The BMP-Volume $_{IA\text{-}in}$ is converted to cubic feet (BMP-Volume $_{IA\text{-}ft}{}^3$) using Equation 3-1:

BMP-Volume $_{IA\text{-}ft}{}^3$ = IA (acre) x BMP-Volume $_{IA\text{-}in}$ x 3,630 ft^3/acre-in
BMP-Volume $_{IA\text{-}ft}{}^3$ = 2.57 acre x 0.36 in x 3,630 ft^3/acre-in
= **3,359 ft^3**

6) A narrow trapezoidal infiltration basin with the following characteristics is proposed to achieve the P $_{Target}$ of 70%. As indicated in Table 3-5, the Design Storage Volume (DSV) of a surface infiltration practice is equal to the volume of surface ponding:

DSV = $(L \times ((W_{bottom}+W_{top@Dmax})/2) \times D)$ (Table 3-5: Surface Infiltration)

Length (ft)	Design Depth (ft)	Side Slopes	Bottom area (ft^2)	Pond surface area (ft^2)	Design Storage Volume (ft^3)
355	1.25	3:1	1,387	4,059	3,404

The proposed DSV of 3,404 ft^3 exceeds the BMP-Volume $_{IA\text{-}ft}{}^3$ needed, 3,359 ft^3 and therefore is sufficient to achieve the P Target of 70%.

7) The cumulative phosphorus load reduction in pounds of phosphorus for the infiltration practice (BMP-Reduction $_{lbs\text{-}P}$) is calculated using Equation 3-2. The BMP Load is first determined using the method described above.

BMP Load = IA x impervious cover PLER for commercial use (see Table 3-1)
= 2.57 acres x 1.78 lbs/acre/yr
= 4.58 lbs/yr
BMP-Reduction $_{lbs\text{-}P}$ = BMP Load x (P $_{target}$ /100)
BMP-Reduction $_{lbs\text{-}P}$ = 4.58 lbs/yr x (70/100)
= **3.21 lbs/yr**

<u>Alternate Solution:</u> Alternatively, the permittee could determine the design storage volume needed for an IR = 0.39 in/hr by performing interpolation of the results from the surface infiltration performance curves for IR = 0.27 in/hr and IR = 0.52 in/hr as follows (replacing steps 3 and 4 on the previous page):

Using the performance curves for the infiltration basin (i.e., surface infiltration practice), Figures 3-8, IR = 0.27 in/hr and 3-9, IR = 0.52 in/hr, interpolate between the curves to determine the design storage volume of the BMP (BMP-Volume $_{IA\text{-}in}$) needed to treat runoff from the contributing IA and achieve a P $_{target}$ = 70%.

First calculate the interpolation adjustment factor (IAF) to interpolate between the infiltration basin performance curves for infiltration rates of 0.27 and 0.52 in/hr:

$$IAF = (0.39 - 0.27)/ (0.52 - 0.27) = 0.48$$

From the two performance curves, develop the following table to estimate the general magnitude of the needed storage volume for an infiltration swale with an IR = 0.39 in/hr and a P $_{target}$ of 70%.

Table Example 3-1-1: Interpolation Table for determining design storage volume of infiltration basin with IR = 0.39 in/hr and a phosphorus load reduction target of 70%

BMP Storage Volume	% Phosphorus Load Reduction IR = 0.27 in/hr ($PR_{IR=0.27}$)	% Phosphorus Load Reduction IR = 0.52 in/hr ($PR_{IR=0.52}$)	Interpolated % Phosphorus Load Reduction IR = 0.39 in/hr ($PR_{IR=0.39}$) **$PR_{IR=0.39}$= IAF($PR_{IR=0.52}$ – $PR_{IR=0.27}$) + $PR_{IR=0.27}$**
0.3	64%	67%	65%
0.4	74%	77%	75%
0.5	79%	82%	80%

As indicated from Table Example 3-1, the BMP-Volume $_{IA\text{-}in}$ for $PR_{IR=0.39}$ of 70% is between 0.3 and 0.4 inches and can be determined by interpolation:

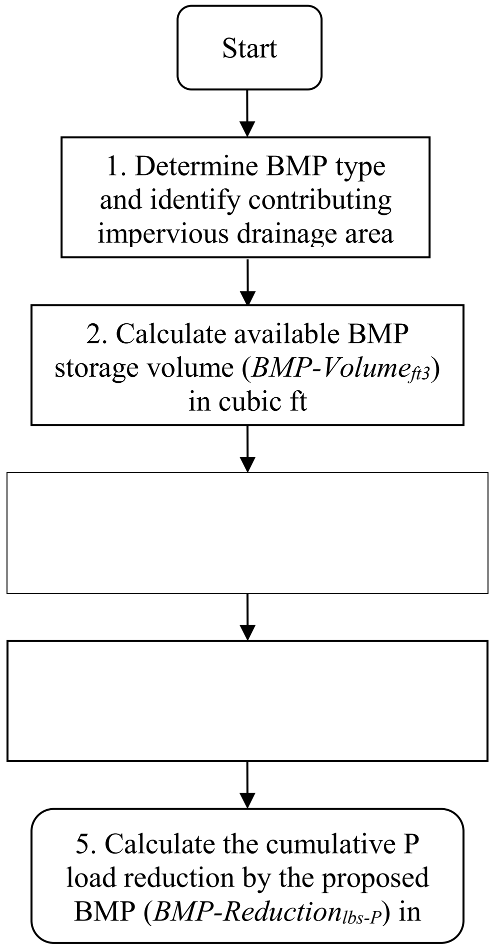
BMP-Volume $_{IA\text{-}in}$ = (70% - 65%)/ (75% - 65%) x (0.4 in – 0.3 in) + 0.3 in
= 0.35 inches

Convert the resulting BMP-Volume $_{IA\text{-}in}$ to cubic feet (BMP-Volume $_{IA\text{-}ft^3}$) using equation 3-1:

BMP-Volume $_{IA\text{-}ft^3}$ = 2.57 acre x 0.35 in x 3,630 ft^3/acre-in
= 3,265 ft^3

(2) <u>Method to determine the phosphorus and/or nitrogen (N/P) load reduction credit for a structural BMP with a known design storage volume when the contributing drainage area is 100% impervious:</u>

Flow Chart 2 illustrates the steps to determine the phosphorus and/or nitrogen (N/P) load reduction for a structural BMP with a known design volume when the contributing drainage area is 100% impervious.



Flow Chart 2: Method to determine the phosphorus and/or nitrogen load reduction for a BMP with a known design volume when contributing drainage area is 100% impervious.

1) Identify the structural BMP type and contributing impervious drainage area (IA);

2) Document the available storage volume (ft^3) of the structural BMP (BMP-Volume $_{ft}{}^3$) using the BMP dimensions and design specifications (e.g., maximum storage depth, filter media porosity);

3) Convert BMP-Volume $_{ft}{}^3$ into inches of runoff from the contributing impervious area (BMP-Volume $_{IA\text{-}in}$) using equation 3-3:

BMP-Volume $_{IA\text{-}in}$ = BMP-Volume $_{ft}{}^3$/ IA (acre) x 12 in/ft x 1 acre/43560 ft^2 **(Equation 3-3)**

4) Determine the % P/N load reduction for the structural BMP (BMP Reduction $_{\%\text{-P}}$) using the appropriate BMP performance curve (Figures 3-1 through 3-20) and the BMP-Volume $_{\text{IA-in}}$ calculated in step 3; and

5) Calculate the cumulative P/N load reduction in pounds for the structural BMP (BMP Reduction $_{\text{lbs-P/N}}$) using the BMP Load as calculated from the procedure described above and the percent P/N load reduction determined in step 4 by using equation 3-4:

BMP Reduction $_{\text{lbs-P/N}}$ = BMP Load x (BMP Reduction $_{\%\text{-P/N}}$/100) **(Equation 3-4)**

Example 3-2: Determine the nitrogen load reduction for a structural BMP with a known storage volume capacity when the contributing drainage area is 100% impervious*:
*The approach used in this example is for nitrogen and is equally applicable for phosphorus.

A permittee is considering an Enhanced Bio-filtration w/ISR system to treat runoff from 1.49 acres of high density residential (HDR) impervious area. Site constraints would limit the enhanced bio-filtration system to have a surface area of 1200 ft^2 and the system would have to be located next to the impervious drainage area to be treated. The design parameters for the enhanced bio-filtration w/ ISR system are presented in Table Example 3-2-1.

Table Example 3-2-1: Design parameters for bio-filtration system for Example 3-2

Components of representation	Parameters	Value
Ponding	Maximum depth	0.5 ft
	Surface area	1200 ft^2
	Vegetative parameter[a]	85-95%
Soil mix	Depth	2.0 ft
	Porosity	0.35
	Hydraulic conductivity	4 inches/hour
Gravel layer	Depth	2.0 ft
	Porosity	0.45
Orifice #1	Diameter	0.08 ft

[a] Refers to the percentage of surface covered with vegetation

Determine the:

A) Percent nitrogen load reduction (BMP Reduction $_{\%\text{-N}}$) for the specified enhanced bio-filtration w/ISR system and contributing impervious HDR drainage area; and

B) Cumulative nitrogen reduction in pounds that would be accomplished by the system (BMP-Reduction $_{\text{lbs-N}}$)

Solution:

1) The BMP is an enhanced bio-filtration w/ISR system that will treat runoff from 1.49 acres of HDR impervious area (IA = 1.49 acre);

2) The available storage volume capacity (ft^3) of the enhanced bio-filtration system (BMP-Volume $_{\text{BMP-ft}^3}$) is determined using the surface area of the system, depth of ponding, and the porosities of the filter media and subsurface gravel ISR:

Solution continued:

BMP-Volume $_{BMP-ft^3}$ = (surface area x pond maximum depth) + (surface area x ((soil mix depth x soil layer porosity) + (gravel layer depth x gravel layer porosity))
= (1,200 ft^2 x 0.5 ft) + (1,200 ft^2 x ((2.0 x 0.35) + (2.0 x 0.45))
= 600 + 1920
= 2,520 ft^3

3) The available storage volume capacity of the enhanced bio-filtration system in inches of runoff from the contributing impervious area (BMP-Volume $_{IA-in}$) is calculated using equation 3-3:

BMP-Volume $_{IA-in}$ = (BMP-Volume $_{ft}$^{3}/ IA (acre) x 12 in/ft x 1 acre/43560 ft^2
BMP-Volume $_{IA-in}$ = (2520 ft^3/1.49 acre) x 12 in/ft x 1 acre/43560 ft^2
= 0.47 in

4) Using the enhanced bio-filtration performance curve shown in Figure 3-15, a **61%** nitrogen load reduction (BMP Reduction %-N) is determined for the system with a design storage capacity of 0.47 inches for treating runoff from 1.49 acres of impervious area; and

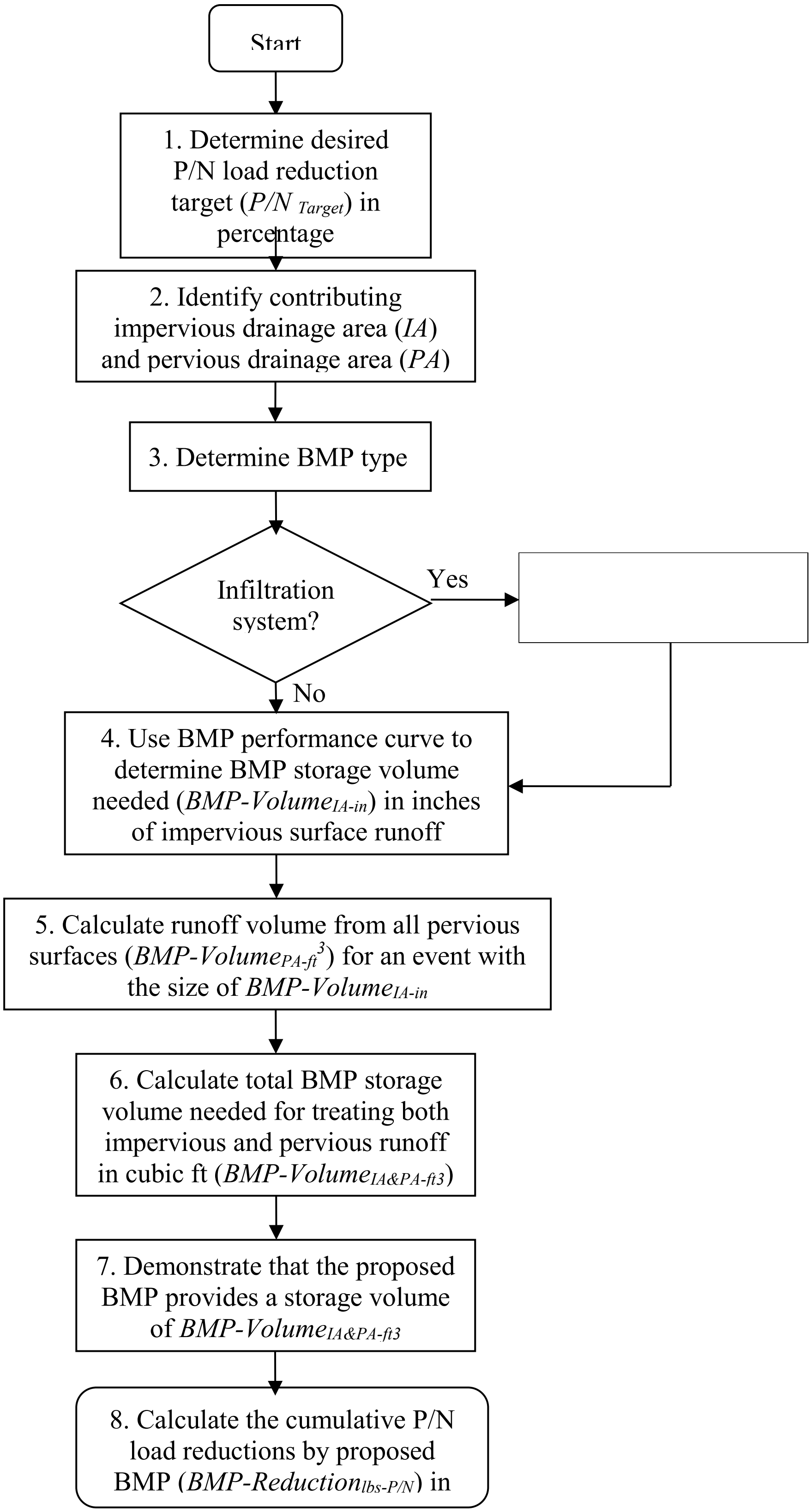
5) Calculate the cumulative nitrogen load reduction in pounds of for the enhanced bio-filtration w/ISR system (BMP Reduction $_{lbs-N}$) using the BMP Load as calculated from the procedure described above and the BMP Reduction $_{\%-N}$ determined in step 4 by using equation 3-4. First, the BMP Load is determined as specified above:

BMP Load $_N$ = IA x impervious cover nitrogen export loading rate for HDR (see Table 3-2)
= 1.49 acres x 15.8 lbs/acre/yr
= 23.5 lbs/yr

BMP Reduction $_{lbs-N}$ = BMP Load x (BMP Reduction $_{\%-P}$/100)
BMP Reduction $_{lbs-N}$ = 23.5 lbs/yr x (61/100)
= **14.4 lbs/yr**

(3) Method to determine the design storage volume of a structural BMP to achieve a known phosphorus and/or nitrogen load reduction target when the contributing drainage area has impervious and pervious surfaces:

Flow Chart 3 illustrates the steps to determine the design storage volume of a structural BMP to achieve a known phosphorus load reduction target when the contributing drainage area has impervious and pervious surfaces.



Flow Chart 3: Method to determine the design storage volume of a BMP to reach a known P/N load reduction when both impervious and pervious drainage areas are present.

1) Determine the desired cumulative P/N load reduction target (P/N_{target}) in percentage for the structural BMP;
2) Characterize the contributing drainage area to the structural BMP by identifying the following information for the impervious and pervious surfaces:
   Impervious area (IA) - Area (acre) and land use (e.g., commercial)
   Pervious area (PA) – Area (acre), land use and hydrologic soil group (HSG).
3) Determine the structural BMP type (e.g., infiltration trench, gravel wetland). For infiltration systems, determine the appropriate infiltration rate for the location of the BMP in the Watershed;
4) Using the cumulative P/N removal performance curve for the selected structural BMP, determine the storage volume capacity of the BMP in inches needed to treat runoff from the contributing impervious area ($BMP\text{-}Volume_{IA\text{-}in}$);
5) Using Equation 3-5 below and the pervious area runoff depth information from Table 3-4, below, determine the total volume of runoff from the contributing pervious drainage area in cubic feet ($BMP\ Volume_{PA\text{-}ft^3}$) for a rainfall size equal to the sum of BMP $Volume_{IA\text{-}in}$, determined in step 4. The runoff volume for each distinct pervious area must be determined;
   $BMP\text{-}Volume_{PA\ ft^3} = \sum (PA \times (\text{runoff depth}) \times 3{,}630\ ft^3/\text{acre-in})_{(PA1,\ PAn)}$ **(Equation 3-5)**
6) Using equation 3-6 below, calculate the BMP storage volume in cubic feet ($BMP\text{-}Volume_{IA\&PA\text{-}ft^3}$) needed to treat the runoff depth from the contributing impervious (IA) and pervious areas (PA);

   $BMP\text{-}Volume_{IA\&PA\text{-}ft^3} = BMP\ Volume_{PA\text{-}ft^3} + (BMP\ Volume_{IA\text{-}in} \times IA\ (\text{acre}) \times 3{,}630\ ft^3/\text{acre-in})$ **(Equation 3-6)**

7) Provide supporting calculations using the dimensions and specifications of the proposed structural BMP showing that the necessary storage volume determined in step 6, $BMP\text{-}Volume_{IA\&PA\text{-}ft^3}$, will be provided to achieve the P/N_{Target}; and
8) Calculate the cumulative phosphorus load reduction in pounds of phosphorus ($BMP\text{-}Reduction_{lbs\text{-}P/N}$) for the structural BMP using the BMP Load (as calculated in example 1) and the P/N_{target} by using equation 3-2:

   $BMP\text{-}Reduction_{lbs\text{-}P/N} = BMP\ Load \times (P_{target}/100)$ **(Equation 3-2)**

Table 3-4 provides values of runoff depth from pervious areas for various rainfall depths and HSGs. Soils are assigned to an HSG on the basis of their permeability. HSG A is the most permeable, and HSG D is the least permeable. HSG categories for pervious areas in the drainage area shall be estimated by consulting local soil surveys prepared by the National Resource Conservation Service (NRCS) or by a storm water professional evaluating soil testing results from the drainage area. If the HSG condition is not known, a HSG C soil condition should be assumed.

Table 3- 4: Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups (HSGs)

Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups					
Rainfall Depth, Inches	Runoff Depth, inches				
	Pervious HSG A	Pervious HSG B	Pervious HSG C	Pervious HSG C/D	Pervious HSG D
0.10	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.00	0.01	0.02	0.02
0.40	0.00	0.00	0.03	0.05	0.06
0.50	0.00	0.01	0.05	0.07	0.09
0.60	0.01	0.02	0.06	0.09	0.11
0.80	0.02	0.03	0.09	0.13	0.16
1.00	0.03	0.04	0.12	0.17	0.21
1.20	0.04	0.05	0.14	0.27	0.39
1.50	0.08	0.11	0.39	0.55	0.72
2.00	0.14	0.22	0.69	0.89	1.08

Notes: Runoff depths derived from combination of volumetric runoff coefficients from Table 5 of *Small Storm Hydrology and Why it is Important for the Design of Stormwater Control Practices*, (Pitt, 1999), and using the Stormwater Management Model (SWMM) in continuous model mode for hourly precipitation data for Boston, MA, 1998-2002.

Example 3-3: Determine the design storage volume of a structural BMP to achieve a known phosphorus load reduction target when the contributing drainage area has impervious and pervious surfaces*:

*The approach used in this example for phosphorus is equally applicable for nitrogen.

A permittee is considering a gravel wetland system to treat runoff from a high-density residential (HDR) site. The site is 7.5 acres of which 4.0 acres are impervious surfaces and 3.50 acres are pervious surfaces. The pervious area is made up of 2.5 acres of lawns in good condition surrounding cluster housing units and 1.0 acre of stable unmanaged woodland. Soils information indicates that all of the woodland and 0.5 acres of the lawn is hydrologic soil group (HSG) B and the other 2.0 acres of lawn are HSG C. The permittee wants to size the gravel wetland system to achieve a cumulative phosphorus load reduction (P_{Target}) of 55% from the entire 7.5 acres.

Determine the:

A) Design storage volume needed for a gravel wetland system to achieve a 55% reduction in annual phosphorus load from the contributing drainage area (BMP-Volume $_{IA\&PA\text{-}ft^3}$); and
B) Cumulative phosphorus reduction in pounds that would be accomplished by the BMP (BMP-Reduction $_{lbs\text{-}P}$)

Example 3-3 continued:
<u>Solution:</u>
1) The BMP type is gravel wetland system.

2) The phosphorus load reduction target (P $_{Target}$) = 55%.

3) Using the cumulative phosphorus removal performance curve for the gravel wetland system shown in Figure 3-14, the storage volume capacity in inches needed to treat runoff from the contributing impervious area (BMP Volume $_{IA\text{-}in}$) is 0.71 in;

Using equation 3-5 and the pervious runoff depth information from Table 3-4, the volume of runoff from the contributing pervious drainage area in cubic feet (BMP Volume $_{PA-ft^3}$) for a rainfall size equal to 0.71 in is summarized in Table Example 3-3-A. As indicated from Table 3-4, the runoff depth for a rainfall size equal to 0.71 inches is between 0.6 and 0.8 inches and can be determined by interpolation (example shown for runoff depth of HSG C):

Runoff depth (HSG C) = (0.71 – 0.6)/(0.8 – 0.6) x (0.09 in – 0.06 in) + 0.06 in
= 0.07 inches

Table Example 3-3-A: Runoff contributions from pervious areas for HDR site

ID	Type	Pervious Area (acre)	HSG	Runoff (in)	Runoff = (runoff) x PA (acre-in)	Runoff = Runoff (acre-in) x 3630 ft^3/acre-in (ft^3)
PA1	Grass	2.00	C	0.07	0.14	508
PA2	Grass	0.50	B	0.01	0.0	0.0
PA3	Woods	1.00	B	0.01	0.0	0.0
Total	-----	**3.50**	-----	-----	**0.14**	**508**

4) Using equation 3-6, determine the BMP storage volume in cubic feet (BMP-Volume $_{IA\&PA\text{-}ft^3}$) needed to treat 0.71 inches of runoff from the contributing impervious area (IA) and the runoff of 0.14 acre-in from the contributing pervious areas, determined in step 5 is:

BMP Volume$_{IA\&PA\text{-}ft^3}$ = BMP Volume $_{PA\ ac\text{-}in}$ + (BMP Volume $_{IA\text{-}in}$ x IA (acre)) x 3,630 ft^3/acre-in)
BMP Volume$_{IA\&PA\text{-}ft^3}$ = (508 ft^3+ ((0.71 in x 4.00 acre) x 3,630 ft^3/acre-in)
= 10,817 ft^3

5) Table Example 3-3-B provides design details for of a potential gravel wetland system

Table Example 3-3-B: Design details for gravel wetland system

Gravel Wetland System Components	Design Detail	Depth (ft)	Surface Area (ft^2)	Volume (ft^3)
Sediment Forebay	**10% of Treatment Volume**			
Pond area	----	1.33	896	1,192
Wetland Cell #1	**45% of Treatment Volume**	--------------	------------------	--------------
Pond area	----	2.00	1,914	3,828
Gravel layer	porosity = 0.4	2.00	1,914	1,531
Wetland Cell #2	**45% of Treatment Volume**	--------------	-----------------	--------------
Pond area	----	2.00	1,914	3,828
Gravel layer	porosity = 0.4	2.00	1,914	1,531

The total design storage volume for the proposed gravel wetland system identified in Table Example 3-3-C is 11,910 ft^3. This volume is greater than 11,834 ft^3 ((BMP-Volume $_{IA\&PA\text{-}ft^3}$), calculated in step 4) and is therefore sufficient to achieve a P $_{Target}$ of 55%.

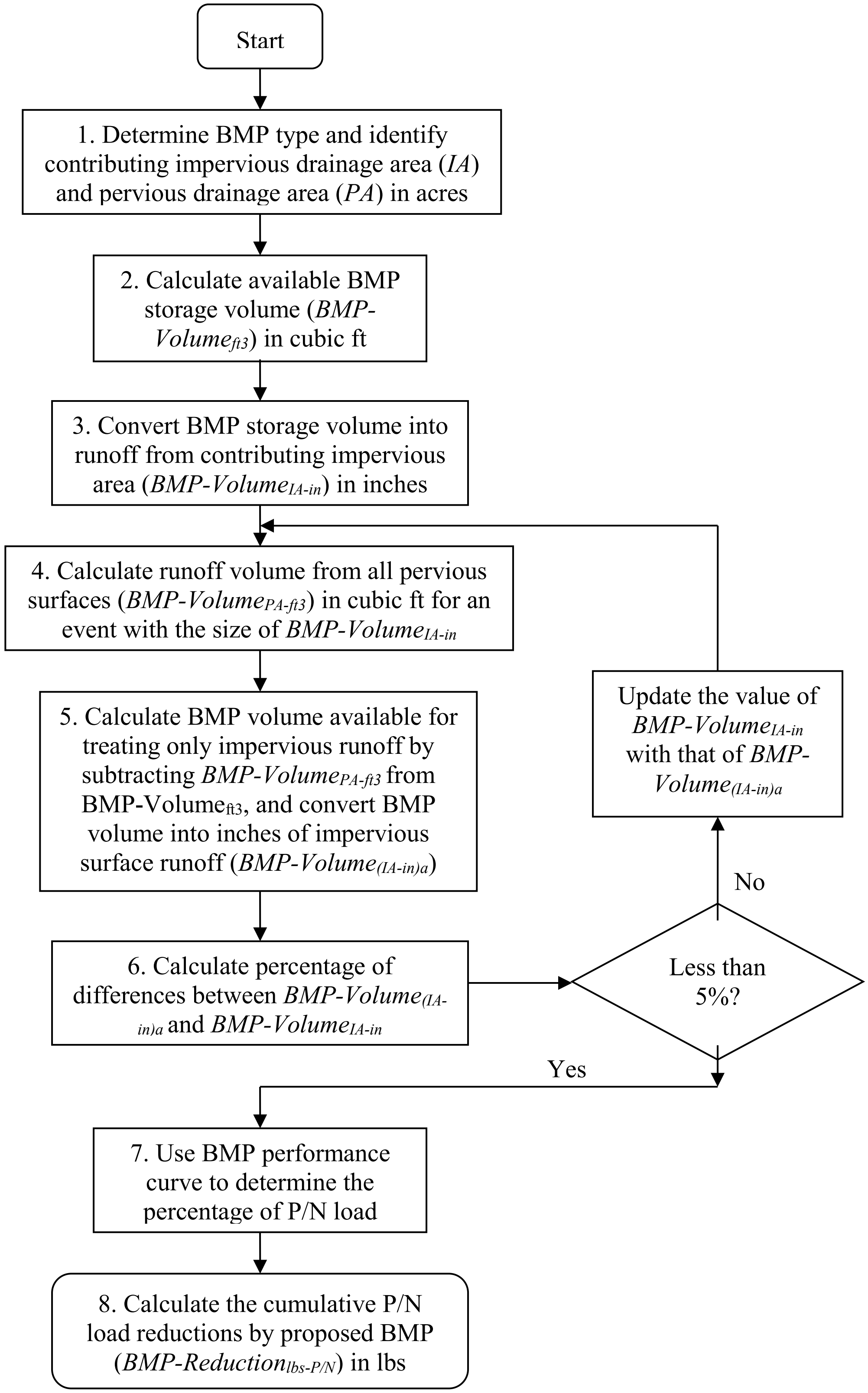
6) The cumulative phosphorus load reduction in pounds of phosphorus (BMP-Reduction $_{lbs\text{-}P}$) for the proposed gravel wetland system is calculated by using equation 3-2 with the BMP Load and the P $_{target}$ = 55%.

BMP-Reduction $_{lbs\text{-}P}$ = BMP Load x (P $_{target}$ /100)   (**Equation 3-2**)

Using Table 3-1, the BMP Load is calculated:
BMP Load = (IA x PLER $_{IC\ HDR}$) + (PA lawn $_{HSG\ B}$ x PLER $_{HSG\ B}$) + (PA lawn $_{HSG\ C}$ x PLER $_{HSG\ C}$) + (PA forest x PA PLER $_{For}$)
= (4.00 acre x 2.32 lbs/acre/yr) + (0.50 acres x 0.12 lbs/acre/yr) + (2.00 acre x 0.21 lbs/acre/yr) + (1.00 acres x 0.13)
= 9.68 lbs/yr
BMP-Reduction $_{lbs\text{-}P}$ = BMP Load x (P $_{target}$ /100)
BMP-Reduction $_{lbs\text{-}P}$ = 9.68 lbs/yr x 55/100
= **5.32 lbs/yr**

(4) Method to determine the phosphorus and/or nitrogen load reduction for a structural BMP with a known storage volume when the contributing drainage area has impervious and pervious surfaces:

Flow Chart 4 illustrates the steps to determine the phosphorus and/or nitrogen (P/N) load reduction for a structural BMP with a known storage volume when the contributing drainage area has impervious and pervious surfaces.



Flow Chart 4: Method to determine the P/N load reduction for a BMP with known storage volume when both pervious and impervious drainage areas are present.

1) Identify the type of structural BMP and characterize the contributing drainage area to the structural BMP by identifying the following information for the impervious and pervious surfaces:

Impervious area (IA) – Area (acre) and land use (e.g., commercial)

Pervious area (PA) – Area (acre), land use, and hydrologic soil group (HSG

2) Determine the available storage volume (ft^3) of the structural BMP (BMP-Volume $_{ft^3}$) using the BMP dimensions and design specifications (e.g., maximum storage depth, filter media porosity);

3) To estimate the P/N load reduction of a BMP with a known storage volume capacity, it is first necessary to determine the portion of available BMP storage capacity (BMP-Volume $_{ft^3}$) that would treat the runoff volume generated from the contributing impervious area (IA) for a rainfall event with a depth of *i* inches (in). This will require knowing the corresponding amount of runoff volume that would be generated from the contributing pervious area (PA) for the same rainfall event (depth of *i* inches). Using equation 3-6a below, solve for the BMP capacity that would be available to treat runoff from the contributing imperious area for the unknown rainfall depth of *i* inches (see equation 3-6b):

$$\text{BMP-Volume}_{ft^3} = \text{BMP-Volume}_{(IA\text{-}ft^3)i} + \text{BMP-Volume}_{(PA\text{-}ft^3)i} \quad \textbf{(Equation 3-6a)}$$

Where:

BMP-Volume $_{ft^3}$= the available storage volume of the BMP;

BMP-Volume $_{(IA\text{-}ft^3)i}$ = the available storage volume of the BMP that would fully treat runoff generated from the contributing impervious area for a rainfall event of size *i* inches; and

BMP-Volume $_{(PA\text{-}ft^3)i}$ = the available storage volume of the BMP that would fully treat runoff generated from the contributing pervious area for a rainfall event of size *i* inches

Solving for BMP-Volume $_{(IA\text{-}ft^3)i}$:

$$\text{BMP-Volume}_{(IA\text{-}ft^3)i} = \text{BMP-Volume}_{ft^3} - \text{BMP-Volume}_{(PA\text{-}ft^3)i} \quad \textbf{(Equation 3-6b)}$$

To determine BMP-Volume $_{(IA\text{-}ft^3)i}$, requires performing an iterative process of refining estimates of the rainfall depth used to calculate runoff volumes until the rainfall depth used results in the sum of runoff volumes from the contributing IA and PA equaling the available BMP storage capacity (BMP-Volume $_{ft^3}$). For the purpose of estimating BMP performance, it will be considered adequate when the IA runoff depth (in) is within 5% IA runoff depth used in the previous iteration.

For the first iteration (1), convert the BMP-Volume $_{ft^3}$ determined in step 2 into inches of runoff from the contributing impervious area (BMP Volume $_{(IA-in)1}$) using equation 3-7a.

BMP-Volume $_{(IA-in)1}$ = (BMP-Volume$_{ft^3}$/ IA (acre)) x (12 in/ft /43,560 ft^2/acre) **(Equation 3-7a)**;

For iterations 2 through n (2…n), convert the BMP Volume $_{(IA-ft^3)2...n}$, determined in step 6) below, into inches of runoff from the contributing impervious area (BMP Volume $_{(IA-in)2…n}$) using equation 3-7b.

BMP-Volume $_{(IA-in)2...n}$ = (BMP-Volume $_{(IA-ft^3)2...n}$ / IA (acre)) x (12 in/ft /43,560 ft^2/acre) **(Equation 3-7b)**;

4) For 1 to n iterations, use the pervious runoff depth information from Table 3-4 (repeated below) and equation 3-8 to determine the total volume of runoff (ft^3) from the contributing PA (BMP Volume $_{PA-ft^3}$) for a rainfall size equal to the sum of BMP-Volume $_{(IA-in)1}$, determined in step 3. The runoff volume for each distinct pervious area must be determined.

BMP Volume $_{(PA-ft^3)1...n}$ = ∑ ((PA x (runoff depth$_{)\ (PA1,\ PA2..PAn)}$ x (3,630 ft^3/acre-in) **(Equation 3-8)**

Table 3-4 provides values of runoff depth from pervious areas for various rainfall depths and HSGs. Soils are assigned to an HSG on the basis of their permeability. HSG A is the most permeable, and HSG D is the least permeable. HSG categories for pervious areas in the drainage area shall be estimated by consulting local soil surveys prepared by the National Resource Conservation Service (NRCS) or by a storm water professional evaluating soil testing results from the drainage area. If the HSG condition is not known, a HSG C soil condition should be assumed.

Table 3- 4: Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups (HSGs) (reprinted for ease of use in example)

Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups					
Rainfall Depth, Inches	Runoff Depth, inches				
	Pervious HSG A	Pervious HSG B	Pervious HSG C	Pervious HSG C/D	Pervious HSG D
0.10	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.00	0.01	0.02	0.02
0.40	0.00	0.00	0.03	0.05	0.06
0.50	0.00	0.01	0.05	0.07	0.09
0.60	0.01	0.02	0.06	0.09	0.11
0.80	0.02	0.03	0.09	0.13	0.16
1.00	0.03	0.04	0.12	0.17	0.21
1.20	0.04	0.05	0.14	0.27	0.39
1.50	0.08	0.11	0.39	0.55	0.72

2.00	**0.14**	**0.22**	**0.69**	**0.89**	**1.08**
Notes: Runoff depths derived from combination of volumetric runoff coefficients from Table 5 of *Small Storm Hydrology and Why it is Important for the Design of Stormwater Control Practices*, (Pitt, 1999), and using the Stormwater Management Model (SWMM) in continuous model mode for hourly precipitation data for Boston, MA, 1998-2002.					

5) For iteration 1, estimate the portion of BMP Volume that is available to treat runoff from only the IA by subtracting BMP-Volume $_{PA\text{-}ft^3}$, determined in step 4, from BMP-Volume $_{ft^3}$, determined in step 2, and convert to inches of runoff from IA (see equations 3-9a and 3-9b):

BMP-Volume $_{(IA\text{-}ft^3)2}$ = ((BMP-Volume$_{ft^3}$- BMP Volume $_{(PA\text{-}ft^3)1}$) **(Equation 3-9a)**

BMP-Volume $_{(IA\text{-}in)2}$ = (BMP-Volume $_{(IA\text{-}ft^3)2}$/IA (acre)) x (12 in/ft x 1 acre/43,560 ft^2) **(Equation 3-9b)**

If additional iterations (i.e., 2 through n) are needed, estimate the portion of BMP volume that is available to treat runoff from only the IA (BMP-Volume $_{(IA\text{-}in)3..n+1}$) by subtracting BMP Volume $_{(PA\text{-}ft^3)2..n}$, determined in step 4, from BMP Volume $_{(IA\text{-}ft^3)3..n+1}$, determined in step 5, and by converting to inches of runoff from IA using equation 3-9b):

6) For iteration a (an iteration between 1 and n+1), compare BMP Volume $_{(IA\text{-}in)a}$ to BMP Volume $_{(IA\text{-}in)a-1}$ determined from the previous iteration (a-1). If the difference in these values is greater than 5% of BMP Volume $_{(IA\text{-}in)a}$ then repeat steps 4 and 5, using BMP Volume $_{(IA\text{-}in)a}$ as the new starting value for the next iteration (a+1). If the difference is less than or equal to 5 % of BMP Volume $_{(IA\text{-}in)a}$ then the permittee may proceed to step 7;

7) Determine the % P/N load reduction for the structural BMP (BMP Reduction $_{\%\text{-}P/N}$) using the appropriate BMP performance curve and the BMP-Volume $_{(IA\text{-}in)n}$ calculated in the final iteration of steps 5 and 6; and

8) Calculate the cumulative P/N load reduction in pounds for the structural BMP (BMP Reduction $_{lbs\text{-}P/N}$) using the BMP Load as calculated Example 3-1 above and the percent P/N load reduction (BMP Reduction $_{\%\text{-}P/N}$) determined in step 7 by using equation 3-4:

BMP Reduction $_{lbs\text{-}P/N}$ = BMP Load x (BMP Reduction $_{\%\text{-}P/N}$/100) **(Equation 3-4)**

Example 3-4: Determine the phosphorus load reduction for a structural BMP with a known design volume when the contributing drainage area has impervious and pervious surfaces:*

*The approach used in this example for phosphorus is equally applicable for nitrogen.

A permittee is considering an infiltration basin to capture and treat runoff from a portion of the medium density residential area (MDR). The contributing drainage area is 16.55 acres and has 11.75 acres of impervious area and 4.8 acres of pervious area (PA) made up mostly of lawns and landscaped areas that is 80% HSG D and 20% HSG C. An infiltration basin with the following specifications can be placed at the down-gradient end of the contributing drainage area where soil testing results indicates an infiltration rate (IR) of 0.28 in/hr:

Table Example 3-4-A: Infiltration basin characteristics

Structure	Bottom area (acre)	Top surface area (acre)	Maximum pond depth (ft)	Design storage volume (ft^3)	Infiltration Rate (in/hr)
Infiltration basin	0.65	0.69	1.65	48,155	0.28

Determine the:

A) Percent phosphorus load reduction (BMP Reduction $_{\%\text{-P}}$) for the specified infiltration basin and the contributing impervious and pervious drainage area; and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the BMP (BMP-Reduction $_{\text{lbs-P}}$)

Solution:

1) A surface infiltration basin is being considered. Information for the contributing impervious (IA) and pervious (PA) areas are summarized in Tables Example 3-4-A and Example 3-4-B, respectively.

Table Example 3-4-B: Impervious area characteristics

ID	Land use	Area (acre)
IA1	MDR	11.75

Table Example 3-4-C: Pervious area characteristics

ID	Area (acre)	Hydrologic Soil Group (HSG)
PA1	3.84	D
PA2	0.96	C

2) The available storage volume (ft^3) of the infiltration basin (BMP-Volume $_{ft^3}$) is determined from the design details and basin dimensions; BMP-Volume $_{ft^3}$ = 48,155 ft^3.

3) To determine what the BMP design storage volume is in terms of runoff depth (in) from IA, an iterative process is undertaken:

Solution Iteration 1

For the first iteration (1), the BMP-Volume$_{ft}^3$ is converted into inches of runoff from the contributing impervious area (BMP Volume $_{(IA\text{-}in)1}$) using equation 3-7a.

BMP Volume $_{(IA\text{-}in)1}$ = (48,155 ft^2/ 11.75 acre) x (12 in/ft /43,560 ft^2/acre)
= 1.13 in

4-1) The total volume of runoff (ft^3) from the contributing PA (BMP Volume $_{PA\text{-}ft}^3$) for a rainfall size equal to the sum of BMP Volume $_{(IA\text{-}in)1}$ determined in step 3 is determined for each distinct pervious area identified in Table Example 3-4-C using the information from Table 3-4 and equation 3-5. Interpolation was used to determine runoff depths.

BMP Volume $_{(PA\text{-}ft^3)1}$ = ((3.84 acre x (0.33 in) + (0.96 acre x (0.13 in)) x 3,630 ft^3/acre-in
= 5052 ft^3

5-1) For iteration 1, the portion of BMP Volume that is available to treat runoff from only the IA is estimated by subtracting the BMP Volume $_{(PA\text{-}ft^3)1}$, determined in step 4-1, from BMP Volume$_{ft}^3$, determined in step 2, and converted to inches of runoff from IA:

BMP Volume $_{(IA\text{-}ft^3)\,2}$ = 48,155 ft^3 – 5052 ft^3
= 43,103 ft^3

BMP Volume $_{(IA\text{-}in)\,2}$ = (43,103 ft^3/11.75 acre) x (12 in/ft x 1 acre/43,560 ft^2)
= 1.01 in

6-1) The % difference between BMP Volume $_{(IA\text{-}in)\,2}$, 1.01 in, and BMP Volume $_{(IA\text{-}in)1}$, 1.13 in is determined and found to be significantly greater than 5%:

% Difference = ((1.13 in – 1.01 in)/1.01 in) x 100
= 12%

Therefore, steps 4 through 6 are repeated starting with BMP Volume $_{(IA\text{-}in)\,2}$ = 1.01 in.

Solution Iteration 2

4-2) BMP-Volume $_{(PA\text{-}ft^3)2}$ = ((3.84 acre x 0.21 in) + (0.96 acre x 0.12 in)) x 3,630 ft^3/acre-in
= 3,345 ft^3

5-2) BMP-Volume $_{(IA\text{-}ft^3)\,3}$ = 48,155 ft^3 – 3,345 ft^3
= 44,810 ft^3

BMP-Volume $_{(IA\text{-}in)\,3}$ = (44,810 ft^3/11.75 acre) x (12 in/ft x 1 acre/43,560 ft^2)
= 1.05 in

6-2) % Difference = ((1.05 in – 1.01 in)/1.05 in) x 100 = 4%

The difference of 4% is acceptable.

7) The % phosphorus load reduction for the infiltration basin (BMP Reduction $_{\%\text{-}P}$) is determined by using the infiltration basin performance curve for an infiltration rate of

0.27 in/hr and the treatment volume (BMP-Volume $_{Net\ IA\text{-}in}$ = 1.05 in) calculated in step 5-2 and is **BMP Reduction $_{\%\text{-}P}$ = 93%**.

The performance curve for IR = 0.27 is used rather than interpolating between the performance curves for IR = 0.27 in/hr and 0.52 in/hr to estimate performance for IR = 0.28 in/hr. An evaluation of the performance curves for IR = 0.27 in/hr and IR = 0.52 in/hr for a design storage volume of 1.05 in indicate a small difference in estimated performance (BMP Reduction $_{\%\text{-}P}$ = 93% for IR = 0.27 in/hr and BMP Reduction $_{\%\text{-}P}$ = 95% for IR = 0.52 in/hr).

8) The cumulative phosphorus load reduction in pounds of phosphorus (BMP-Reduction $_{lbs\text{-}P}$) for the proposed infiltration basin is calculated by using equation 3-2 with the BMP Load and the P $_{target}$ of 93%.

BMP-Reduction $_{lbs\text{-}P}$ = BMP Load x (P $_{target}$ /100) **(Equation 3-2)**

Using Table 3-1, the BMP load is calculated:
BMP Load = (IA x impervious cover phosphorus export loading rate for industrial)
+ (PA $_{HSG\ D}$ x pervious cover phosphorus export loading rate for HSG D)
+ (PA $_{HSG\ C}$ x pervious cover phosphorus export loading rate for HSG C)

BMP Load = (11.75 acre x 1.96 lbs/acre/yr) + (3.84 acre x 0.37 lbs/acre/yr)
+ (0.96 acre x 0.21 lbs/acre/yr)
= 24.65 lbs/yr

BMP-Reduction $_{lbs\text{-}P}$ = 24.65 lbs/yr x 93/100 = **22.92 lbs/yr**

Example 3-5: Determine the phosphorus and nitrogen load reductions for disconnecting impervious area using storage with delayed release:

A commercial operation has an opportunity to divert runoff from 0.75 acres of impervious roof top to a 5000 gallon (668.4 ft^3) storage tank for temporary storage and subsequent release to 0.09 acres of pervious area (PA) with HSG C soils.
Determine the:

A) Percent phosphorus and nitrogen load reduction rates (BMP Reduction $_{\%\text{-}P\&N}$) for the specified impervious area (IA) disconnection and storage system assuming release times of 1, 2 and 3 days for the stored volumes to discharge to the pervious area; and
B) Cumulative phosphorus and nitrogen load reductions in pounds that would be accomplished by the system (BMP-Reduction $_{lbs\text{-}P\&N}$) for the three storage release times, 1, 2 and 3 days.

Solution:

1. Determine the storage volume in units of inches of runoff depth from contributing impervious area:
   Storage Volume $_{IA\text{-}in}$ = (668.4 ft^3/(0.75 acre x 43.560 ft^2/acre)) x 12 inch/ft
   = 0.25 inches

2. Determine the ratio of the contributing impervious area to the receiving pervious area:
   IA:PA = 0.75 acres/0.09 acres
   = 8.3
3. Using Table 3-26 or Figure 3-23 for a IA:PA ratio of 8:1, determine the phosphorus and nitrogen load reduction rates for a storage volume of 0.25 inches that discharges to HSG C with release rates of 1, 2 and 3 days: Using interpolation the reduction rates are shown in Table 3-5-A:

Table Example 3-5-A: P&N Reduction Rates

Percent Phosphorus & Nitrogen load reduction for IA disconnection with storage to PA HSG C			
Storage Volume $_{IA\text{-}in}$	Storage release rate, days		
	1	2	3
0.25	39%	42%	43%

4. The cumulative phosphorus and nitrogen load reductions in pounds of phosphorus for the IA disconnection with storage (BMP-Reduction $_{lbs\text{-}P/N}$) is calculated using Equation 3-2. The BMP Loads for phosphorus and nitrogen are first determined using the method presented in Example 3-1.
   <u>Phosphorus:</u>
   BMP Load $_P$ = IA (acre) x PLER $_{IC\text{-}Com}$ (see Table 3-1)
   = 0.75 acres x 1.78 lbs/acre/yr
   = 1.34 lbs/yr
   BMP Reduction $_{lbs\text{-}P}$ = BMP Load x (BMP Reduction $_{\%\text{-}P}$/100)
   BMP Reduction $_{lbs\text{-}P}$ = 1.34 lbs/yr x (39/100)
   = **0.53 lbs/yr**
   Table Example 3-5-B presents the BMP Reduction $_{lbs\text{-}P}$ for each of the release rates:

Table Example 3-5-B: P Reduction Loads

Phosphorus load reduction for IA disconnection with storage to PA HSG C, lbs			
Storage Volume $_{IA\text{-}in}$	Storage release rate, days		
	1	2	3
0.25	0.53	0.56	0.58

   <u>Nitrogen:</u>
   BMP Load $_N$ = IA (acre) x NLER $_{IC\text{-}Com}$ (see Table 3-2)
   = 0.75 acres x 15.0 lbs/acre/yr
   = 11.3 lbs/yr
   BMP Reduction $_{lbs\text{-}N}$ = BMP Load x (BMP Reduction $_{\%\text{-}P}$/100)
   BMP Reduction $_{lbs\text{-}N}$ = 11.3 lbs/yr x (39/100)
   BMP Reduction $_{lbs\text{-}N}$ = **4.4 lbs/yr**

Table Example 3-5-C presents the BMP Reduction $_{lbs\text{-}N}$ for each of the release rates:

Table Example 3-5-C: N Reduction Loads

Nitrogen load reduction for IA disconnection with storage to PA HSG C, lbs			
Storage Volume IA-in	Storage release rate, days		
	1	2	3
0.25	4.4	4.7	4.9

Example 3-6: Determine the phosphorus load reduction for disconnecting impervious area with and without soil augmentation in the receiving pervious area:*

*The approach used in this example for phosphorus is equally applicable for nitrogen

The same commercial property as in Example 3-5 wants to evaluate disconnecting drainage from the 0.75 acre impervious roof top and discharging it directly to 0.09 acres of pervious area (PA) with HSG C. Also, the property has the opportunity to purchase a small adjoining area (0.06 acres), also HSG C, to increase the size of the receiving PA from 0.09 to 0.15 acres and to allow the property owner to avoid having to install a drainage structure to capture overflow runoff from the PA. The property owner has been informed that the existing PA soil can be tilled and augmented with soil amendments to support denser vegetative growth and improve hydrologic function to approximate HSG B.

Determine the:

A) Percent phosphorus load reduction rates (BMP Reduction $_{\%\text{-}P}$) for the specified impervious area (IA) disconnection to both the 0.09 and 0.15 acre receiving PAs with and without soil augmentation; and
B) Cumulative phosphorus reductions in pounds that would be accomplished by the IA disconnection for the various scenarios (BMP-Reduction $_{lbs\text{-}P}$).

Solution:

1. Determine the ratio of the contributing impervious area to the receiving pervious area:

   IA:PA = 0.75 acres/0.09 acres
   = 8.3
   IA:PA = 0.75 acres/0.15 acres
   = 5.0

2. Using Table 3-31 and Figure 3-41 for a IA:PA ratios of 8:1 and 5:1, respectively, determine the phosphorus load reduction rates for IA disconnections to HSG C and HSG B:

Table Example 3-6-A: Reduction Rates

Percent Phosphorus load reduction rates for IA disconnection		
Receiving PA	**IA:PA**	
	8:1	5:1
HSG C	7%	14%
HSG B (soil augmentation)	14%	22%

3. The cumulative phosphorus load reduction in pounds of phosphorus for the IA disconnection with storage (BMP-Reduction $_{lbs\text{-}P}$) is calculated using Equation 3-2. The BMP Load was calculated in example 3-5 and is 1.34 lbs/yr.

   BMP Reduction $_{lbs\text{-}P}$ = BMP Load x (BMP Reduction $_{\%\text{-}P}$/100)
   For PA of 0.09 acres HSG C the BMP Reduction $_{lbs\text{-}P}$ is calculated as follows:
   BMP Reduction $_{lbs\text{-}P(0.09ac\text{-}\ HSG\ C)}$ = 1.34 lbs/yr x (7/100)
   = **0.09 lbs/yr**
   Table Example 3-6-B presents the BMP Reduction $_{lbs\text{-}P}$ for each of the scenarios:

Table Example 3-6-B: Reduction

Pounds Phosphorus load reduction for IA disconnection, lbs/yr		
Receiving PA	**Area of Receiving PA, acres**	
	0.09	**0.15**
HSG C	0.09	0.19
HSG B (soil augmentation)	0.19	0.29

Example 3-7: Determine the phosphorus load reduction for converting impervious area to permeable/pervious area:*
*The approach used in this example for phosphorus is equally applicable for nitrogen.

A municipality is planning upcoming road reconstruction work in medium density residential (MDR) neighborhoods, and has identified an opportunity to convert impervious surfaces to permeable/pervious surfaces by narrowing the road width of 3.7 miles (mi) of roadway from 32 feet (ft) to 28 ft and eliminating 3.2 miles of 4 ft wide paved sidewalk (currently there are sidewalks on both sides of the roadways targeted for restoration). The newly created permeable/pervious area will be tilled and treated with soil amendments to support vegetated growth in order to restore hydrologic function to at least HSG B.
Determine the:

A) Percent phosphorus load reduction rate (BMP Reduction $_{\%\text{-}P}$) for the conversion of impervious area (IA) to permeable/pervious area (PA); and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the project (BMP-Reduction $_{lbs\text{-}P}$).

Solution:

1. Determine the area of IA to be converted to PA:

   New PA = (((3.7 mi x 4 ft) + (3.2 mi x 4 ft)) x 5280 ft/mi)/43,560 ft^2/acre
   = 3.35 acres

2. Using Table 3-32, the phosphorus load reduction rate for converting IA to HSG B is 94.1%
3. The BMP Load is first determined using the method described above.

   BMP Load = IA x phosphorus export loading rate for MDR IA (see Table 3-1)
   = 3.35 acres x 1.96 lbs/acre/yr
   = 6.57 lbs/yr

4. The cumulative phosphorus load reduction in pounds of phosphorus for the IA conversion (BMP-Reduction $_{lbs\text{-}P}$) is calculated using Equation 3-2.

   BMP Reduction $_{lbs\text{-}P}$ = BMP Load x (BMP Reduction $_{\%\text{-}P}$/100)
   BMP Reduction $_{lbs\text{-}P}$ = 6.57 lbs/yr x (94.1/100)
   = 6.18 lbs/yr

Table 3-5 Method for determining stormwater control design volume (DSV) (i.e., capacity) using long-term cumulative performance curves

Stormwater Control Type	Description	Applicable Structural Stormwater Control Performance Curve	Equation for calculating Design Storage Capacity for Estimating Cumulative Reductions using Performances Curves
Infiltration Trench	Provides temporary storage of runoff using the void spaces within the soil/sand/gravel mixture that is used to backfill the trench for subsequent infiltration into the surrounding sub-soils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = void space volumes of gravel and sand layers DSV = (L x W x D_{stone} x n_{stone})+ (L x W x D_{sand} x n_{sand})
Subsurface Infiltration	Provides temporary storage of runoff using the combination of storage structures (e.g., galleys, chambers, pipes, etc.) and void spaces within the soil/sand/gravel mixture that is used to backfill the system for subsequent infiltration into the surrounding sub-soils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Water storage volume of storage units and void space volumes of backfill materials. Example for subsurface galleys backfilled with washed stone: DSV = $(L \times W \times D)_{galley}$ + (L x W x D_{stone} x n_{stone})
Surface Infiltration	Provides temporary storage of runoff through surface ponding storage structures (e.g., basin or swale) for subsequent infiltration into the underlying soils.	Infiltration Basin (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Water volume of storage structure before bypass. Example for linear trapezoidal vegetated swale DSV = (L x ((W_{bottom}+$W_{top@Dmax}$)/2) x D)
Rain Garden/Bio-retention (no underdrains)	Provides temporary storage of runoff through surface ponding and possibly void spaces within the soil/sand/gravel mixture that is used to filter runoff prior to infiltration into underlying soils.	Infiltration Basin (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Ponding water storage volume and void space volumes of soil filter media. Example for raingarden: DSV = (A_{pond} x D_{pond}) + (A_{soil} x D_{soil} x $n_{soil\ mix}$)
Tree Filter (no underdrain)	Provides temporary storage of runoff through surface ponding and void spaces within the soil/sand/gravel mixture that is used to filter runoff prior to infiltration into underlying soils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Ponding water storage volume and void space volumes of soil filter media. DSV = (L x W x $D_{ponding}$) + (L x W x D_{soil} x $n_{soil\ mix}$)
Bio-Filtration (w/underdrain)	Provides temporary storage of runoff for filtering through an engineered soil media. The storage capacity includes void spaces in the filter media and temporary ponding at the surface. After runoff has passed through the filter media it is collected by an under-drain pipe for discharge. Manufactured or packaged bio-filter systems such as tree box filters may be suitable for using the bio-filtration performance results.	Bio-filtration	DSV = Ponding water storage volume and void space volume of soil filter media. Example of a linear biofilter: DSV = (L x W x $D_{ponding}$)+ (L x W x D_{soil} x n_{soil})
Enhanced Bio-filtration w/ Internal Storage Reservoir (ISR) (no infiltration)	Based on design by the UNH Stormwater Center (UNHSC). Provides temporary storage of runoff for filtering through an engineered soil media, augmented for enhanced phosphorus removal, followed by detention and denitrification in a subsurface internal storage reservoir (ISR) comprised of gravel. An elevated outlet control at the top of the ISR is designed to provide a retention time of at least 24 hours in the system to allow for sufficient time for denitrification and nitrogen reduction to occur prior to discharge. The design storage capacity for using the cumulative performance curves is comprised of void spaces in the filter media, temporary ponding at the surface of the practice and the void spaces in the gravel ISR.	Enhanced Bio-filtration w/ISR	DSV = Ponding water storage volume and void space volume of soil filter media and gravel ISR. DSV =(A_{bed} x $D_{ponding}$)+(A_{bed} x D_{soil} x n_{soil})+(A_{ISR} x D_{gravel} x n_{gravel})
Gravel Wetland	Provides temporary surface ponding storage of runoff in a vegetated wetland cell that is eventually routed to an underlying saturated gravel internal storage reservoir (ISR) for nitrogen treatment. Outflow is controlled by an elevated orifice that has its invert elevation equal to the top of the ISR layer and provides a retention time of at least 24 hours.	Gravel Wetland	DSV = pretreatment volume + ponding volume + void space volume of gravel ISR. DSV = ($A_{pretreatment}$ x $D_{preTreatment}$)+ ($A_{wetland}$ x $D_{ponding}$)+(A_{ISR} x D_{gravel} x n_{gravel})
Porous Pavement with subsurface infiltration	Provides filtering of runoff through a filter course and temporary storage of runoff within the void spaces of a subsurface gravel reservoir prior to infiltration into subsoils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = void space volumes of gravel layer DSV = (L x W x D_{stone} x n_{stone})
Porous pavement w/ impermeable underliner w/underdrain	Provides filtering of runoff through a filter course and temporary storage of runoff within the void spaces prior to discharge by way of an underdrain.	Porous Pavement	Depth of Filter Course = D_{FC}
Sand Filter w/underdrain	Provides filtering of runoff through a sand filter course and temporary storage of runoff through surface ponding and within void spaces of the sand and washed stone layers prior to discharge by way of an underdrain.	Sand Filter	DSV = pretreatment volume + ponding volume + void space volume of sand and washed stone layers. DSV = ($A_{pretreatment}$ x $D_{preTreatment}$)+ (A_{bed} x $D_{ponding}$)+ (A_{bed} x D_{sand} x n_{sand}) + (A_{bed} x D_{stone} x n_{stone})
Wet Pond	Provides treatment of runoff through routing through permanent pool.	Wet Pond	DSV= Permanent pool volume prior to high flow bypass DSV=A_{pond} x D_{pond} (does not include pretreatment volume)
Extended Dry Detention Basin	Provides temporary detention storage for the design storage volume to drain in 24 hours through multiple out let controls.	Dry Pond	DSV= Ponding volume prior to high flow bypass DSV=A_{pond} x D_{pond} (does not include pretreatment volume)
Dry Water Quality Swale/Grass Swale	Based on MA design standards. Provides temporary surface ponding storage of runoff in an open vegetated channel through permeable check dams. Treatment is provided by filtering of runoff by vegetation and check dams and infiltration into subsurface soils.	Water Quality Grass Swale	DSV = Volume of swale at full design depth DSV=L_{swale} x W_{swale} x $D_{ponding\ swale}$

Definitions: DSV= Design Storage Volume = physical storage capacity to hold water; **VSV** = Void Space Volume; **L** = length, **W** = width, **D** = depth at design capacity before bypass, **n** = porosity fill material, **A**= average surface area for calculating volume; **Infiltration rate** = saturated soil hydraulic conductivity

Table 3- 6: Infiltration Trench (IR = 0.17 in/hr) BMP Performance Table

Infiltration Trench (IR = 0.17 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	15%	28%	49%	64%	75%	82%	92%	95%
Cumulative Phosphorus Load Reduction	18%	33%	57%	73%	83%	90%	97%	99%
Cumulative Nitrogen Load Reduction	56%	72%	87%	93%	96%	98%	99%	100%

Figure 3- 1: BMP Performance Curve: Infiltration Trench (infiltration rate = 0.17 in/hr)

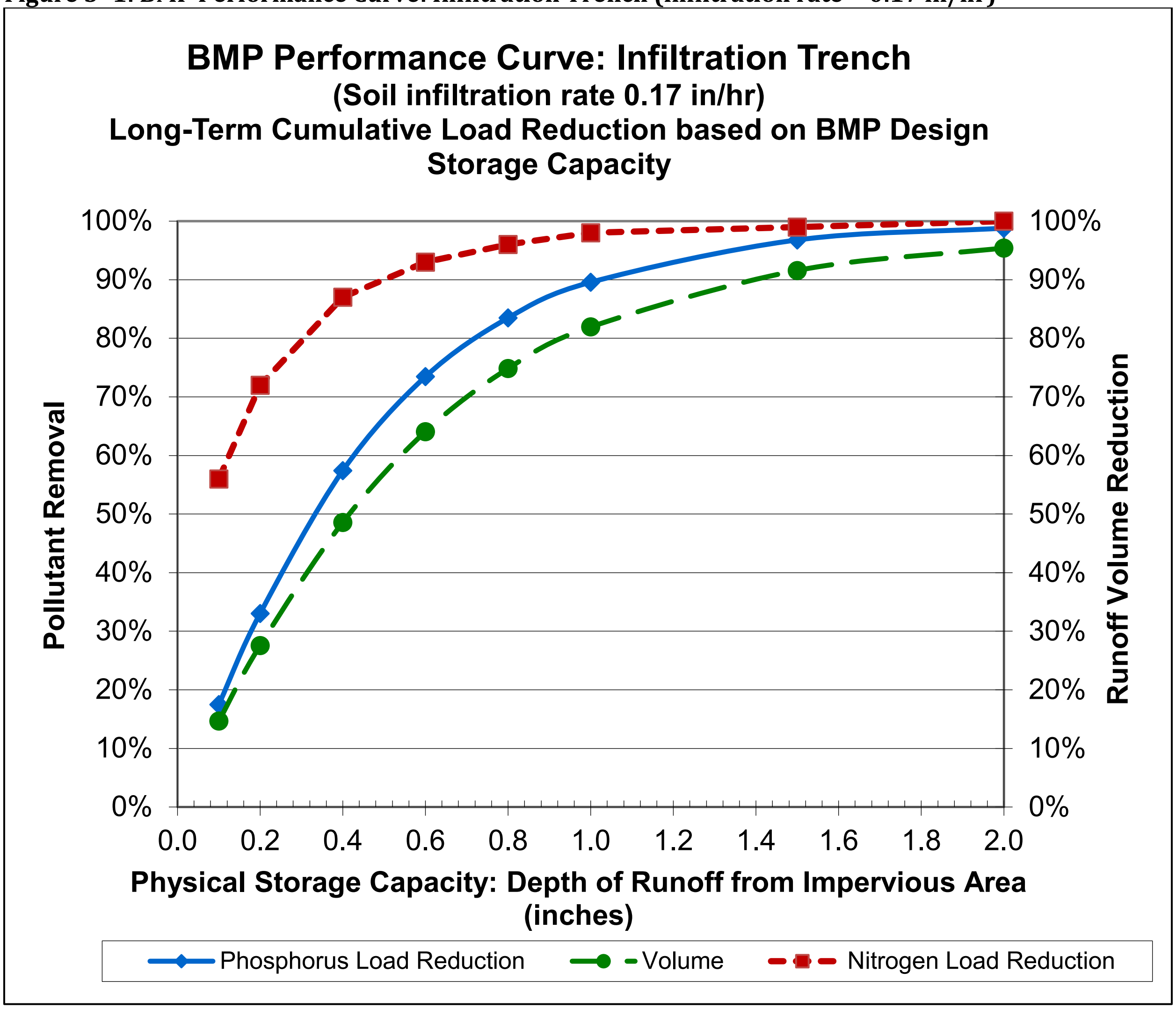


Table 3- 7: Infiltration Trench (IR = 0.27 in/hr) BMP Performance Table

Infiltration Trench (IR = 0.27 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	17.8%	32.5%	55.0%	70.0%	79.3%	85.2%	93.3%	96.3%
Cumulative Phosphorus Load Reduction	20%	37%	63%	78%	86%	92%	97%	99%
Cumulative Nitrogen Load Reduction	57%	74%	88%	94%	97%	98%	99%	100%

Figure 3- 2: BMP Performance Curve: Infiltration Trench (infiltration rate = 0.27 in/hr)

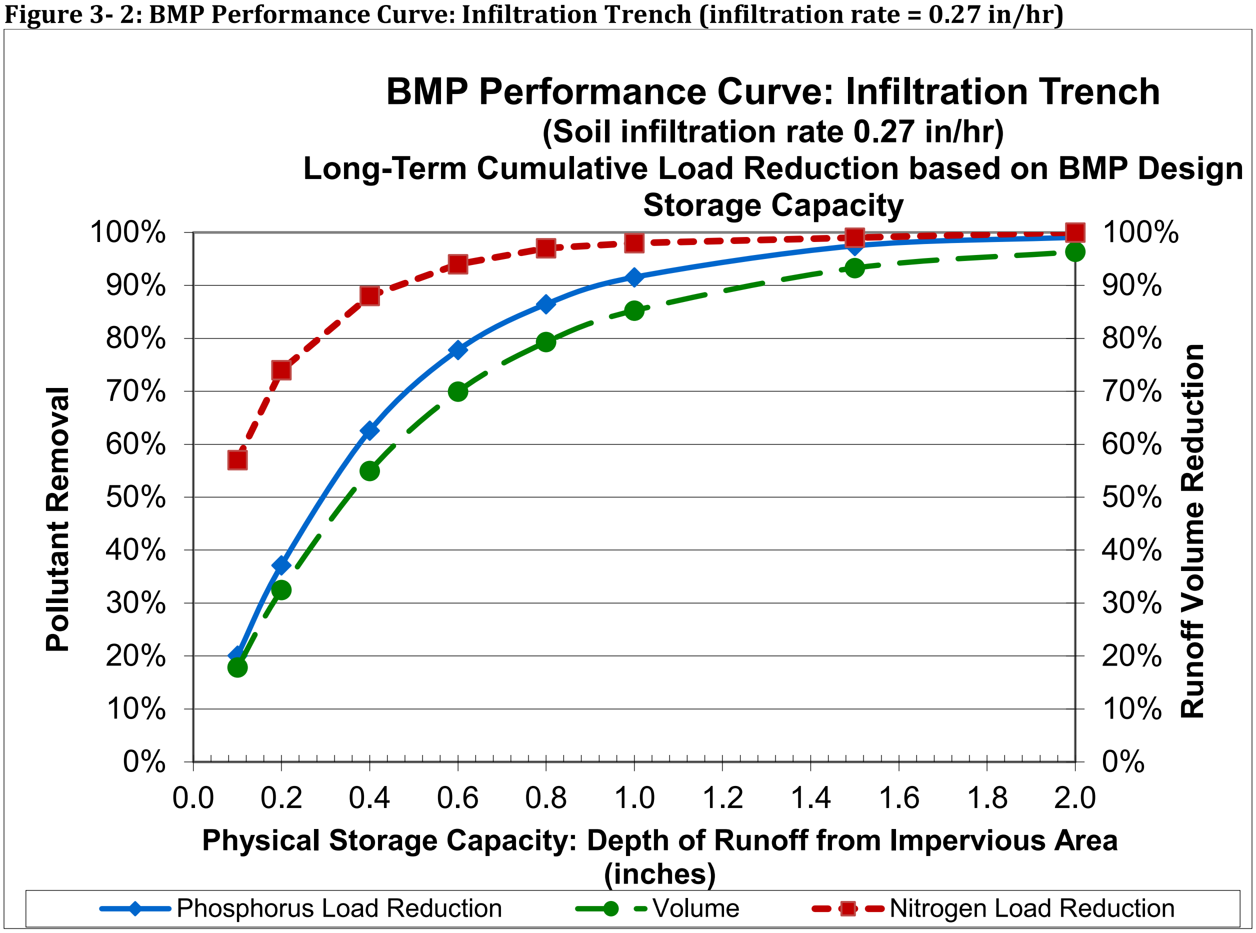


Table 3- 8: Infiltration Trench (IR = 0.52 in/hr) BMP Performance Table

Infiltration Trench (IR = 0.52 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	22.0%	38.5%	61.8%	75.7%	83.7%	88.8%	95.0%	97.2%
Cumulative Phosphorus Load Reduction	23%	42%	68%	82%	89%	94%	98%	99%
Cumulative Nitrogen Load Reduction	59%	76%	90%	95%	98%	99%	100%	100%

Figure 3- 3: BMP Performance Curve: Infiltration Trench (infiltration rate = 0.52 in/hr)

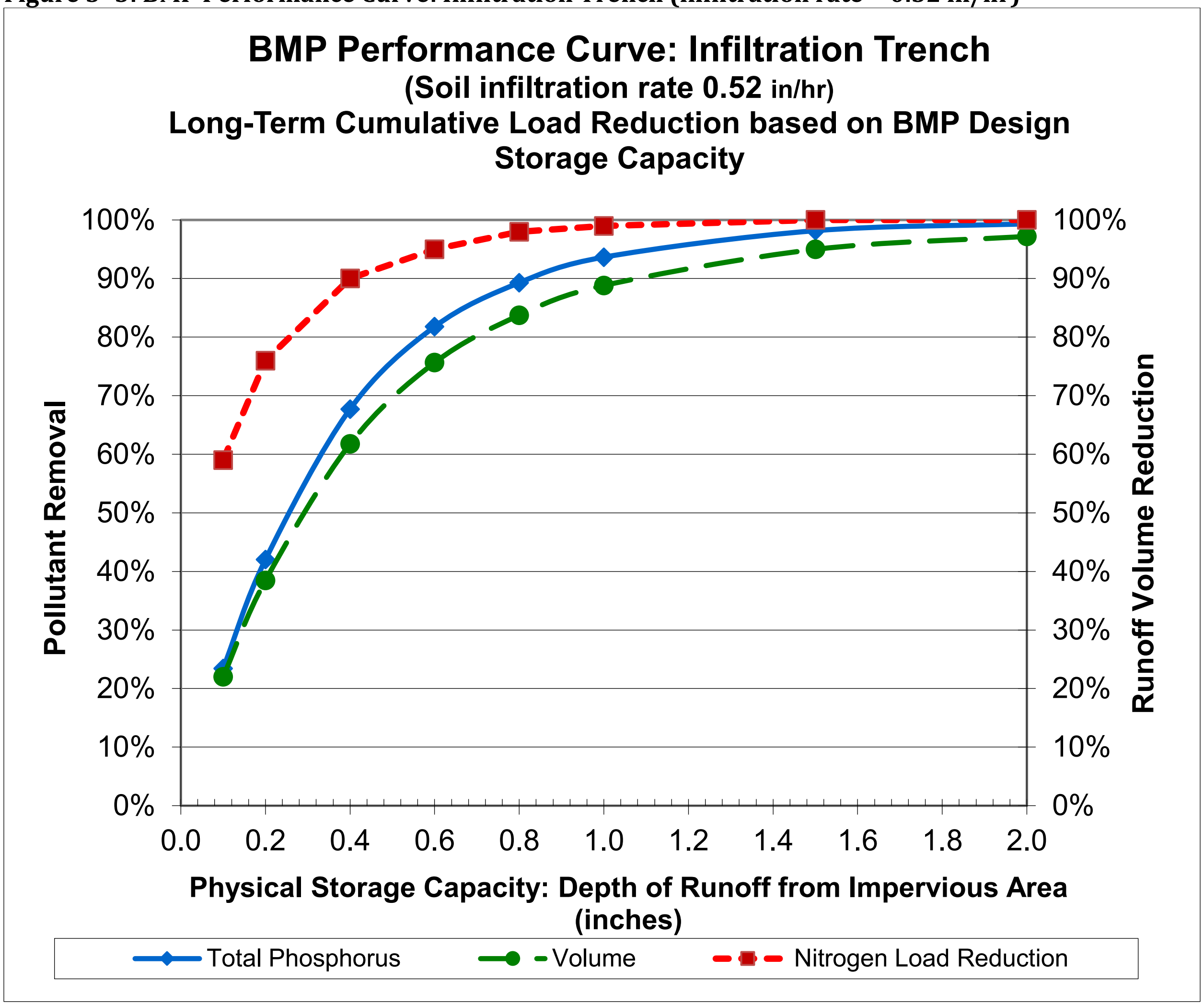


Table 3- 9: Infiltration Trench (IR = 1.02 in/hr) BMP Performance Table

Infiltration Trench (IR = 1.02 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	26.3%	44.6%	68.2%	81.0%	88.0%	92.1%	96.5%	98.3%
Cumulative Phosphorus Load Reduction	27%	47%	73%	86%	92%	96%	99%	100%
Cumulative Nitrogen Load Reduction	61%	78%	92%	97%	98%	99%	100%	100%

Figure 3- 4: BMP Performance Curve: Infiltration Trench (infiltration rate = 1.02 in/hr)

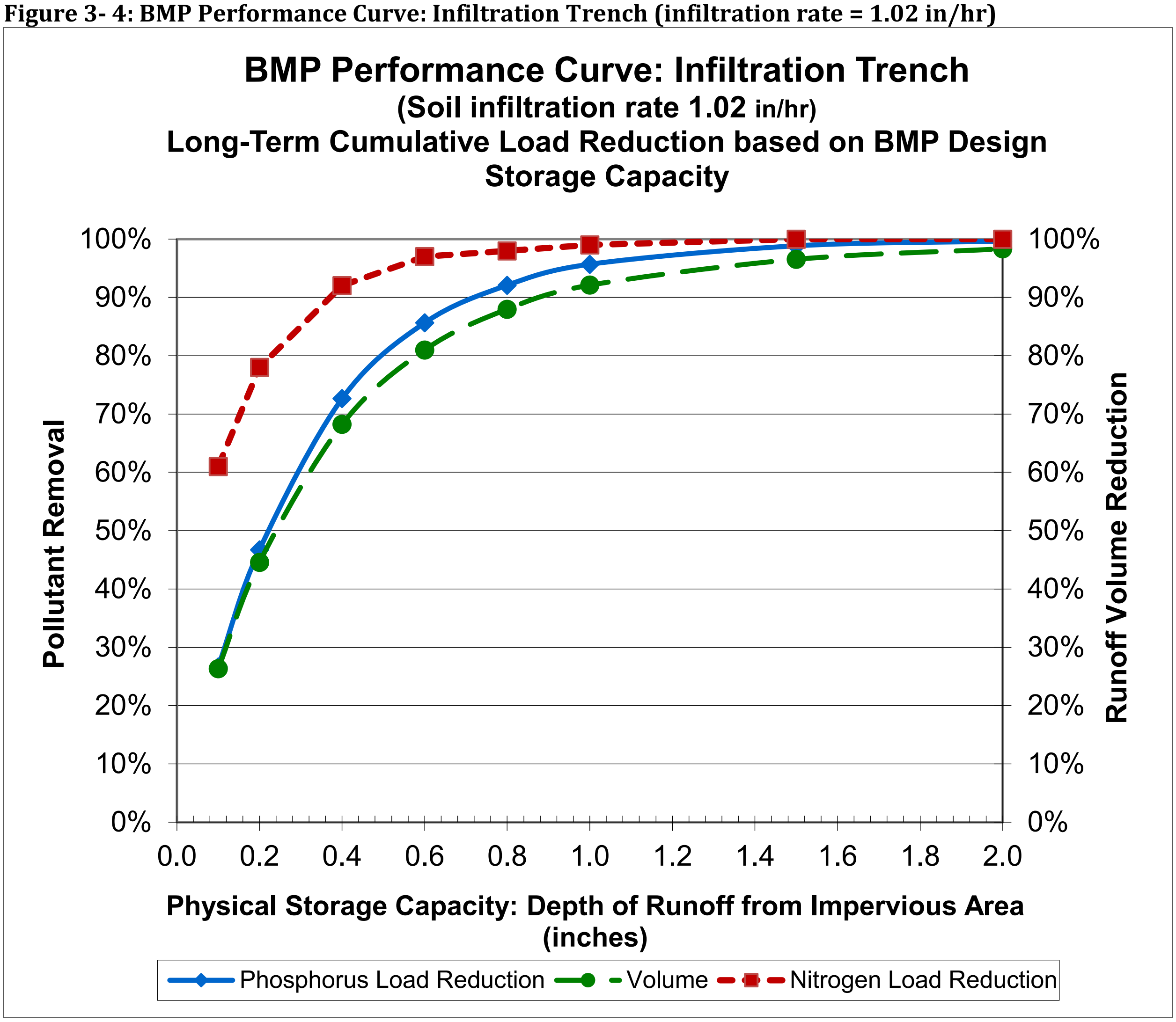


Table 3- 10: Infiltration Trench (IR = 2.41 in/hr) BMP Performance Table

Infiltration Trench (IR = 2.41 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	34%	55%	78%	88%	93%	96%	99%	100%
Cumulative Phosphorus Load Reduction	33%	55%	81%	91%	96%	98%	100%	100%
Cumulative Nitrogen Load Reduction	65%	83%	95%	98%	99%	100%	100%	100%

Figure 3- 5: BMP Performance Curve: Infiltration Trench (infiltration rate = 2.41 in/hr)

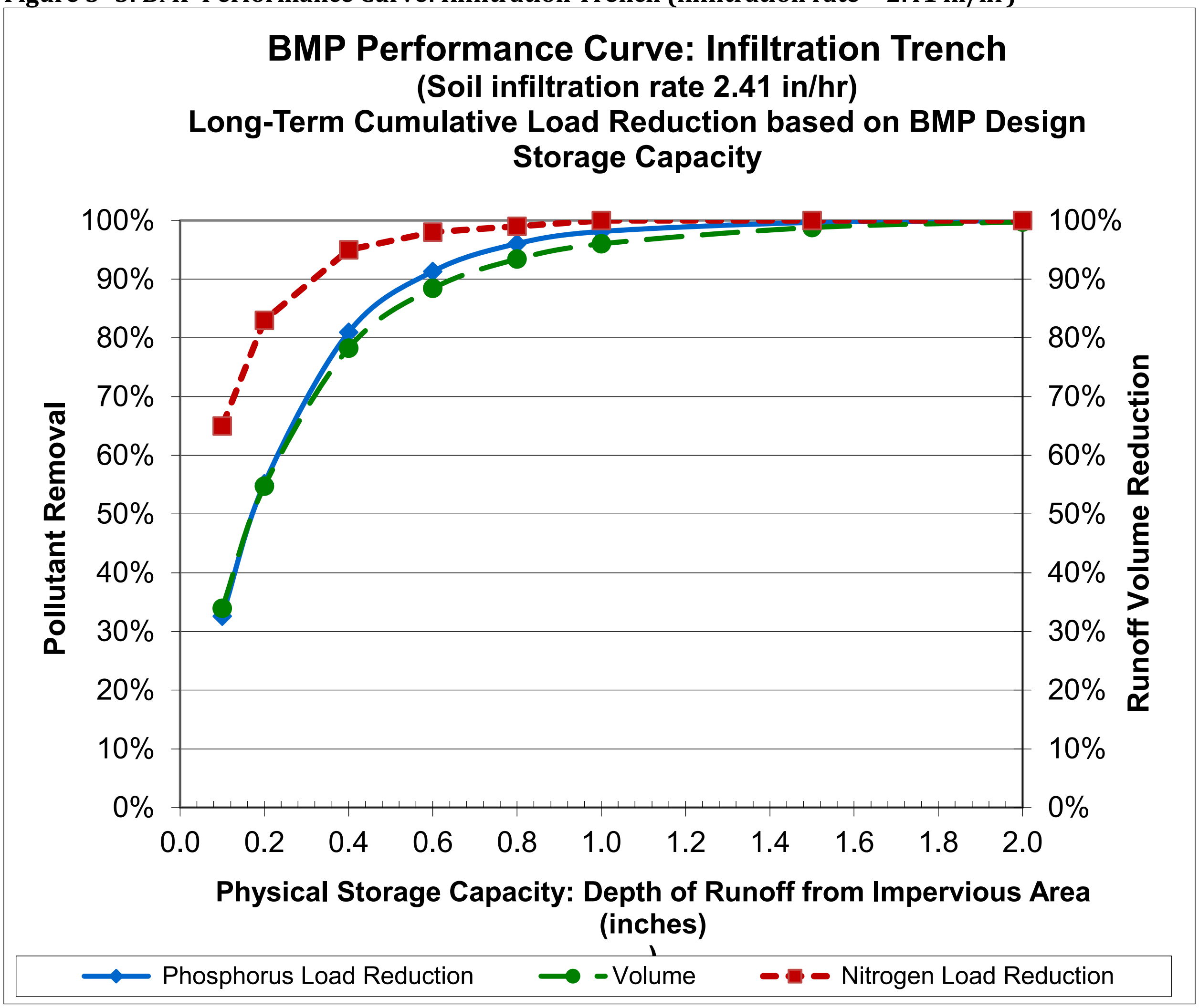


Table 3- 11: Infiltration Trench (8.27 in/hr) BMP Performance Table

Infiltration Trench (8.27 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	53.6%	76.1%	92.6%	97.2%	98.9%	99.5%	100.0%	100.0%
Cumulative Phosphorus Load Reduction	50%	75%	94%	98%	99%	100%	100%	100%
Cumulative Nitrogen Load Reduction	76%	92%	98%	100%	100%	100%	100%	100%

Figure 3- 6: BMP Performance Curve: Infiltration Trench (infiltration rate = 8.27 in/hr)

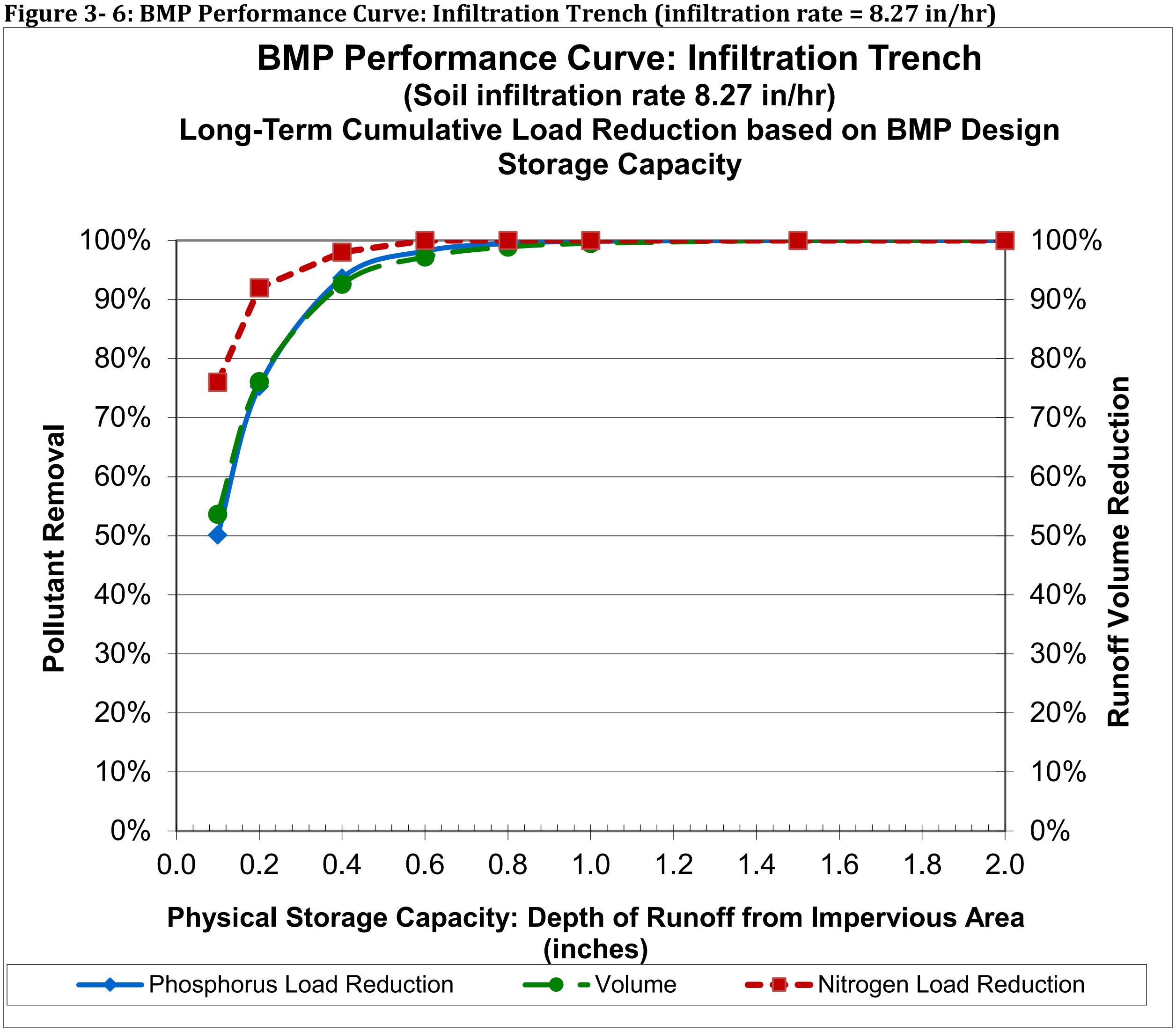


Table 3- 12: Surface Infiltration (0.17 in/hr) BMP Performance Table

Surface Infiltration (0.17 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	13%	25%	44%	59%	71%	78%	89%	94%
Cumulative Phosphorus Load Reduction	35%	52%	72%	82%	88%	92%	97%	99%
Cumulative Nitrogen Load Reduction	52%	69%	85%	92%	96%	98%	99%	100%

Figure 3- 7: BMP Performance Curve: Infiltration Basin (infiltration rate = 0.17 in/hr)

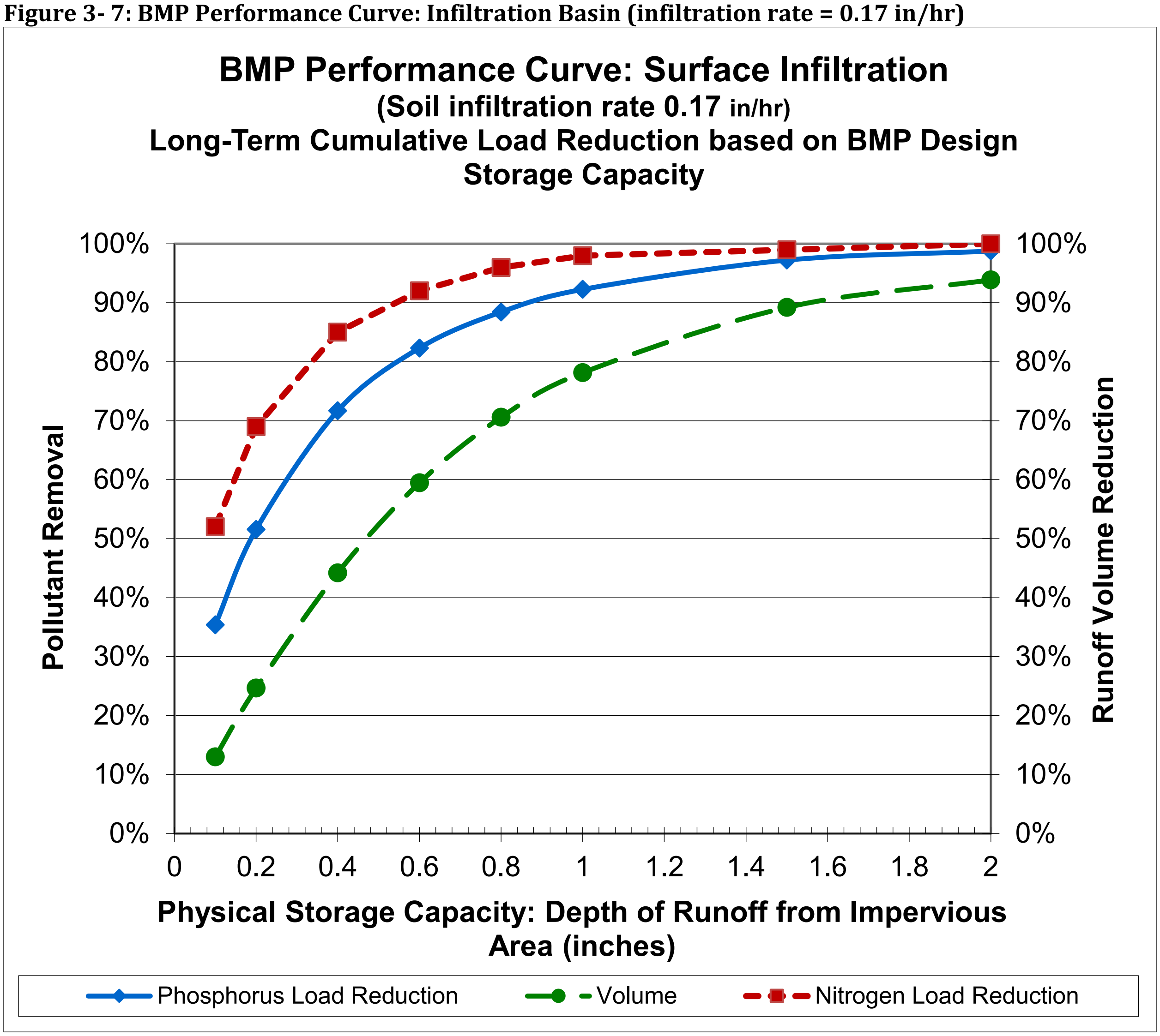


Table 3- 13: Infiltration Basin (0.27 in/hr) BMP Performance Table

Surface Infiltration (0.27 in/hr) BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	16%	30%	51%	66%	76%	82%	91%	95%
Cumulative Phosphorus Load Reduction	37%	54%	74%	85%	90%	93%	98%	99%
Cumulative Nitrogen Load Reduction	54%	71%	87%	93%	97%	98%	99%	100%

Figure 3- 8: BMP Performance Curve: Surface Infiltration (infiltration rate = 0.27 in/hr)

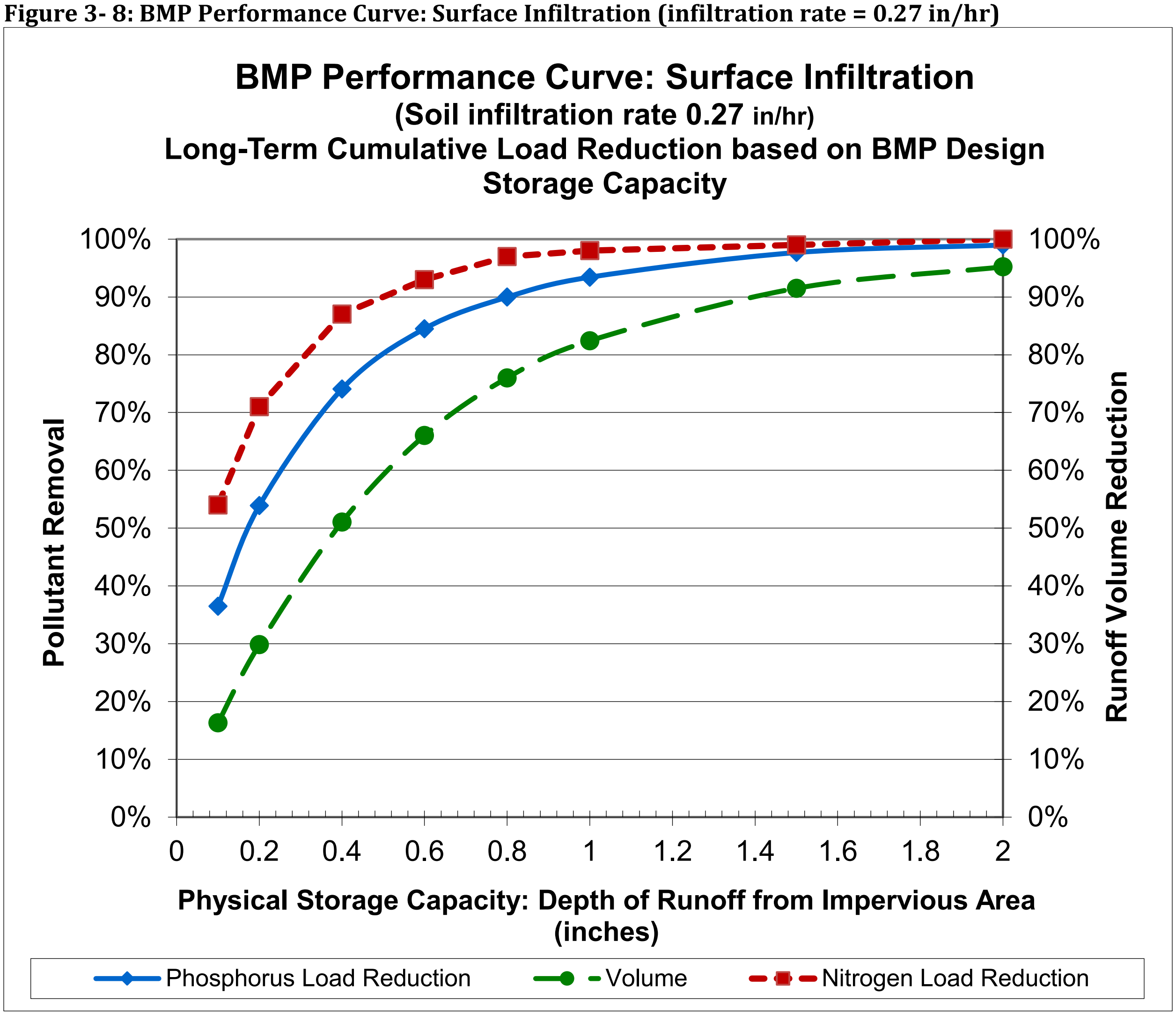


Table 3- 14: Infiltration Basin (0.52 in/hr) BMP Performance Table

Surface Infiltration (0.52 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	20%	36%	58%	73%	81%	87%	94%	97%
Cumulative Phosphorus Load Reduction	38%	56%	77%	87%	92%	95%	98%	99%
Cumulative Nitrogen Load Reduction	56%	74%	89%	94%	98%	99%	100%	100%

Figure 3- 9: BMP Performance Curve: Surface Infiltration (infiltration rate = 0.52 in/hr)

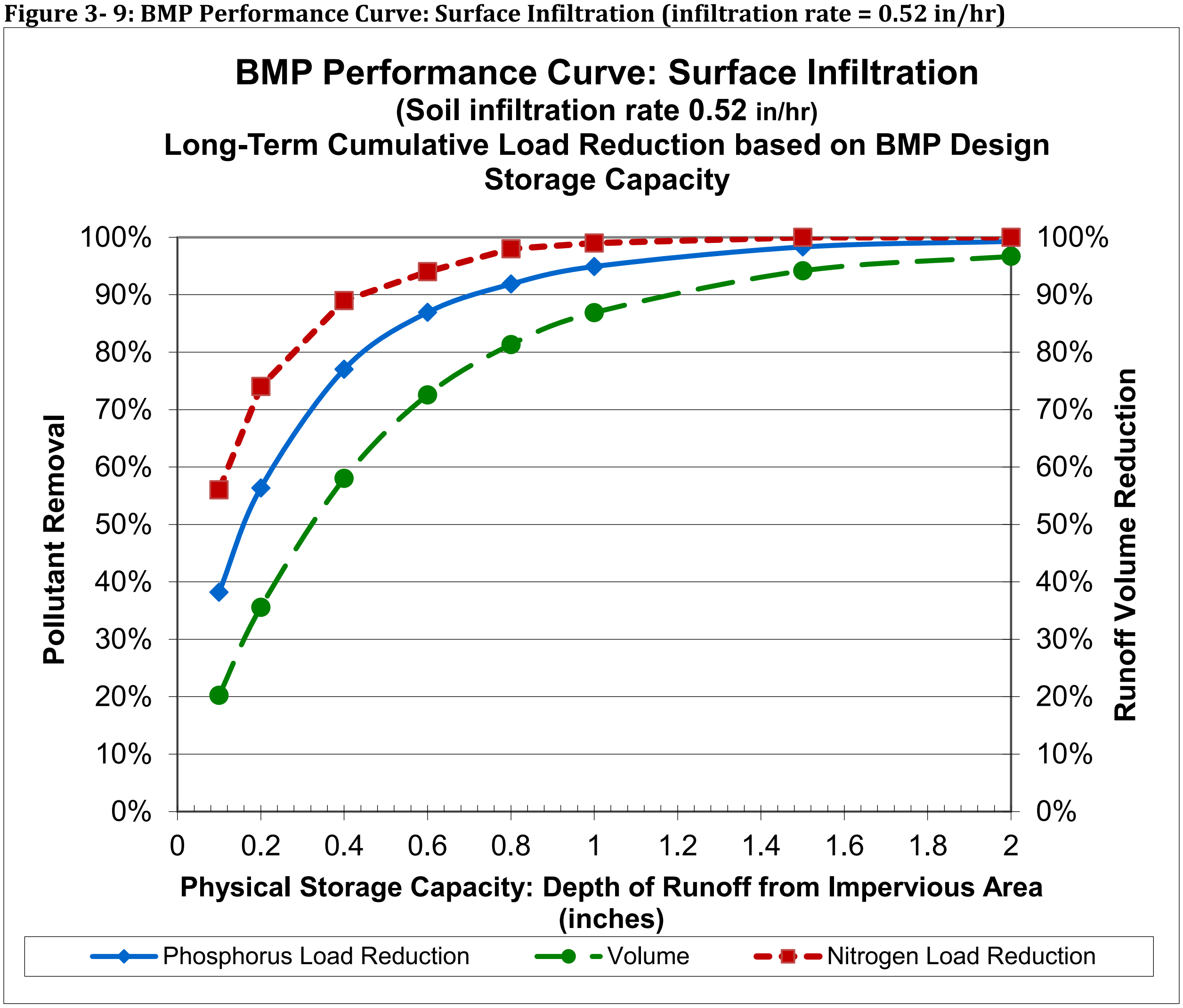


Table 3-15: Infiltration Basin (1.02 in/hr) BMP Performance Table

Surface Infiltration (1.02 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	24.5%	42.0%	65.6%	79.4%	86.8%	91.3%	96.2%	98.1%
Cumulative Phosphorus Load Reduction	41%	60%	81%	90%	94%	97%	99%	100%
Cumulative Nitrogen Load Reduction	59%	77%	92%	96%	98%	100%	100%	100%

Figure 3- 10: BMP Performance Curve: Surface Infiltration (Soil infiltration rate = 1.02 in/hr)

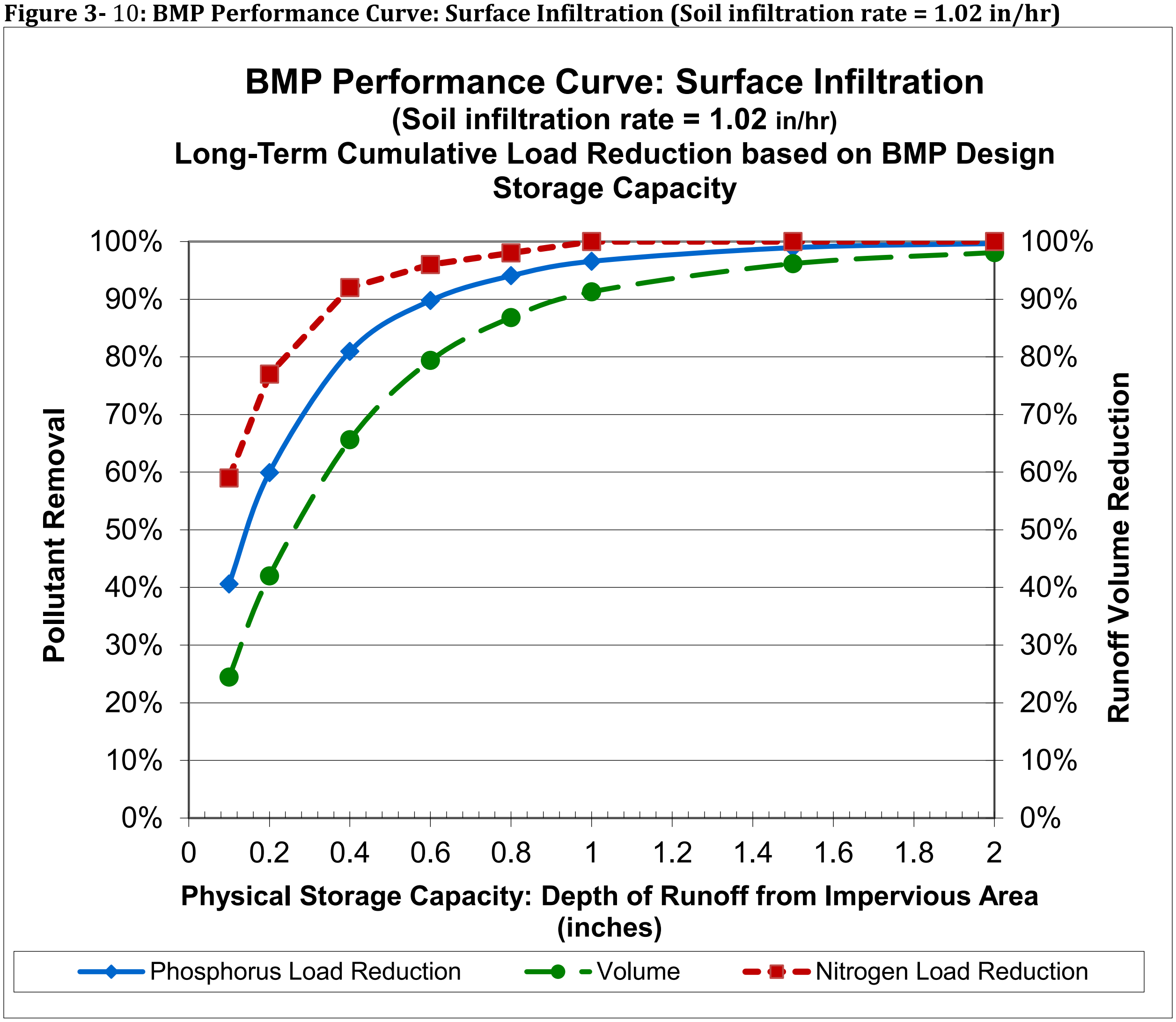


Table 3- 16: Surface Infiltration (2.41 in/hr) BMP Performance Table

Surface Infiltration (2.41 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	32.8%	53.8%	77.8%	88.4%	93.4%	96.0%	98.8%	99.8%
Cumulative Phosphorus Load Reduction	46%	67%	87%	94%	97%	98%	100%	100%
Cumulative Nitrogen Load Reduction	64%	82%	95%	98%	99%	100%	100%	100%

Figure 3- 11: BMP Performance Curve: Infiltration Basin (infiltration rate = 2.41 in/hr)

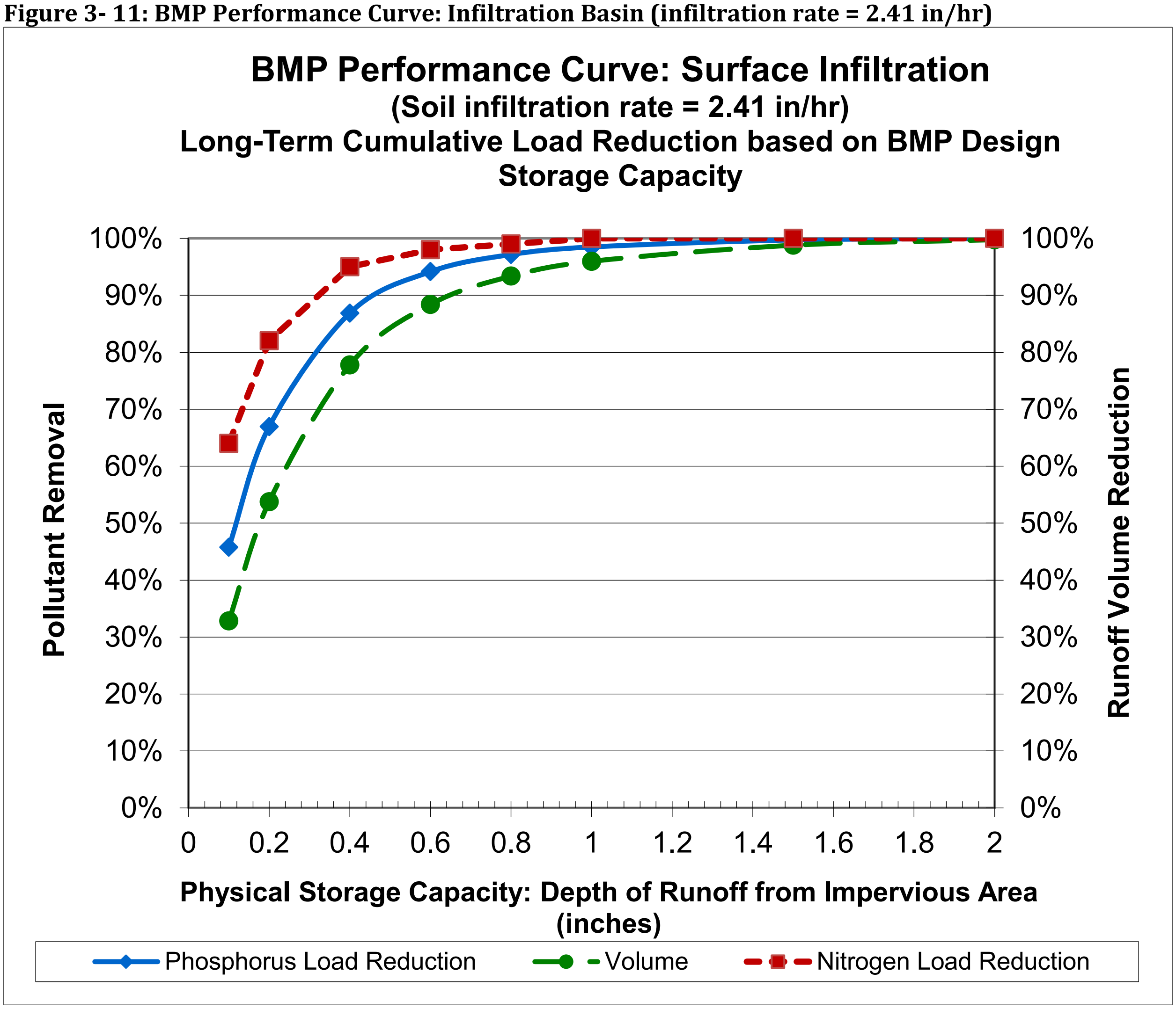


Table 3- 17: Surface Infiltration (8.27 in/hr) BMP Performance Table

Surface Infiltration (8.27 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	54.6%	77.2%	93.4%	97.5%	99.0%	99.6%	100.0%	100.0%
Cumulative Phosphorus Load Reduction	59%	81%	96%	99%	100%	100%	100%	100%
Cumulative Nitrogen Load Reduction	75%	92%	99%	100%	100%	100%	100%	100%

Figure 3- 12: BMP Performance Curve: Surface Infiltration (infiltration rate = 8.27 in/hr)

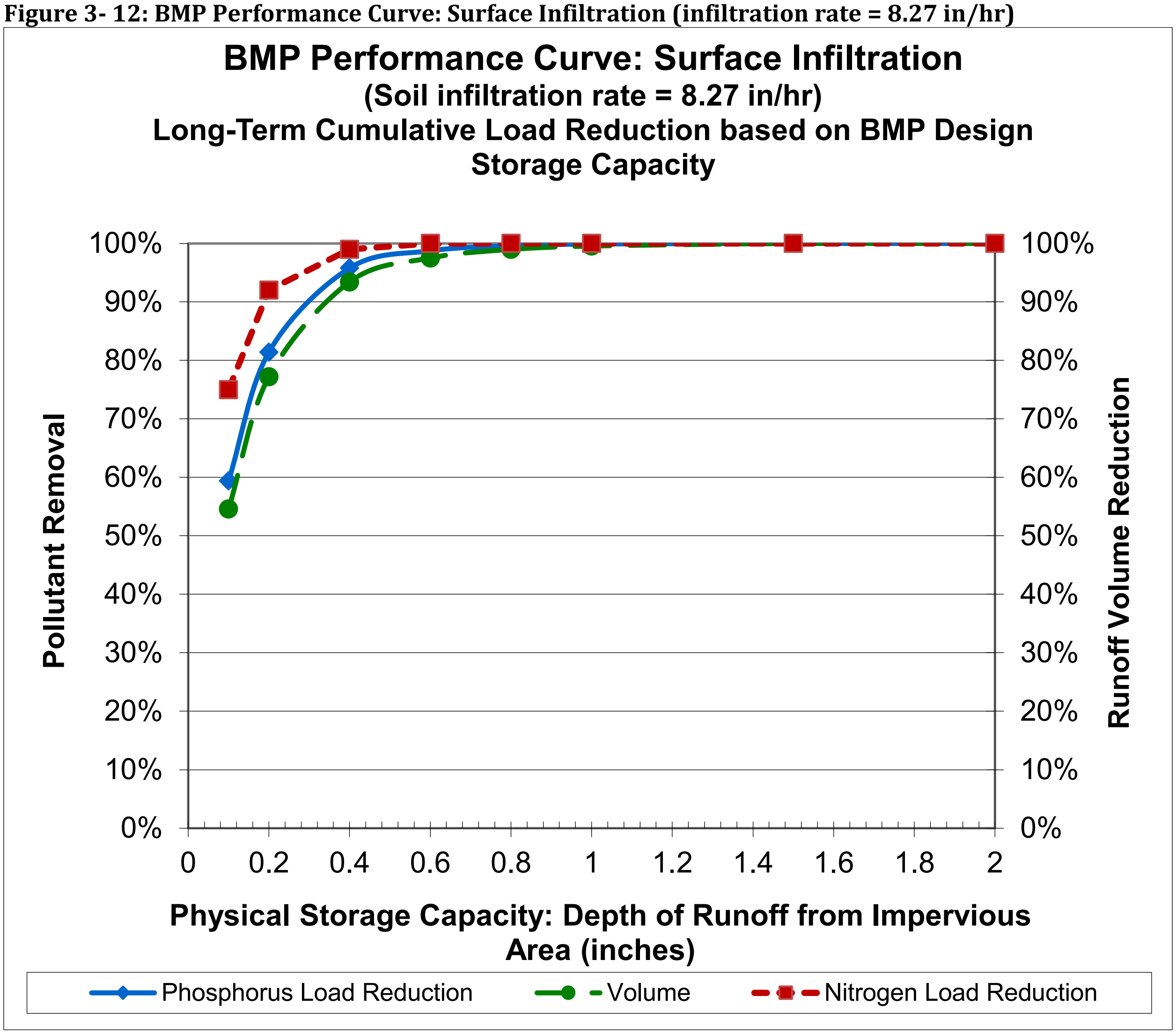


Table 3-18: Bio-filtration BMP Performance Table

Bio-filtration BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%

Figure 3- 13: BMP Performance Curve: Bio-filtration

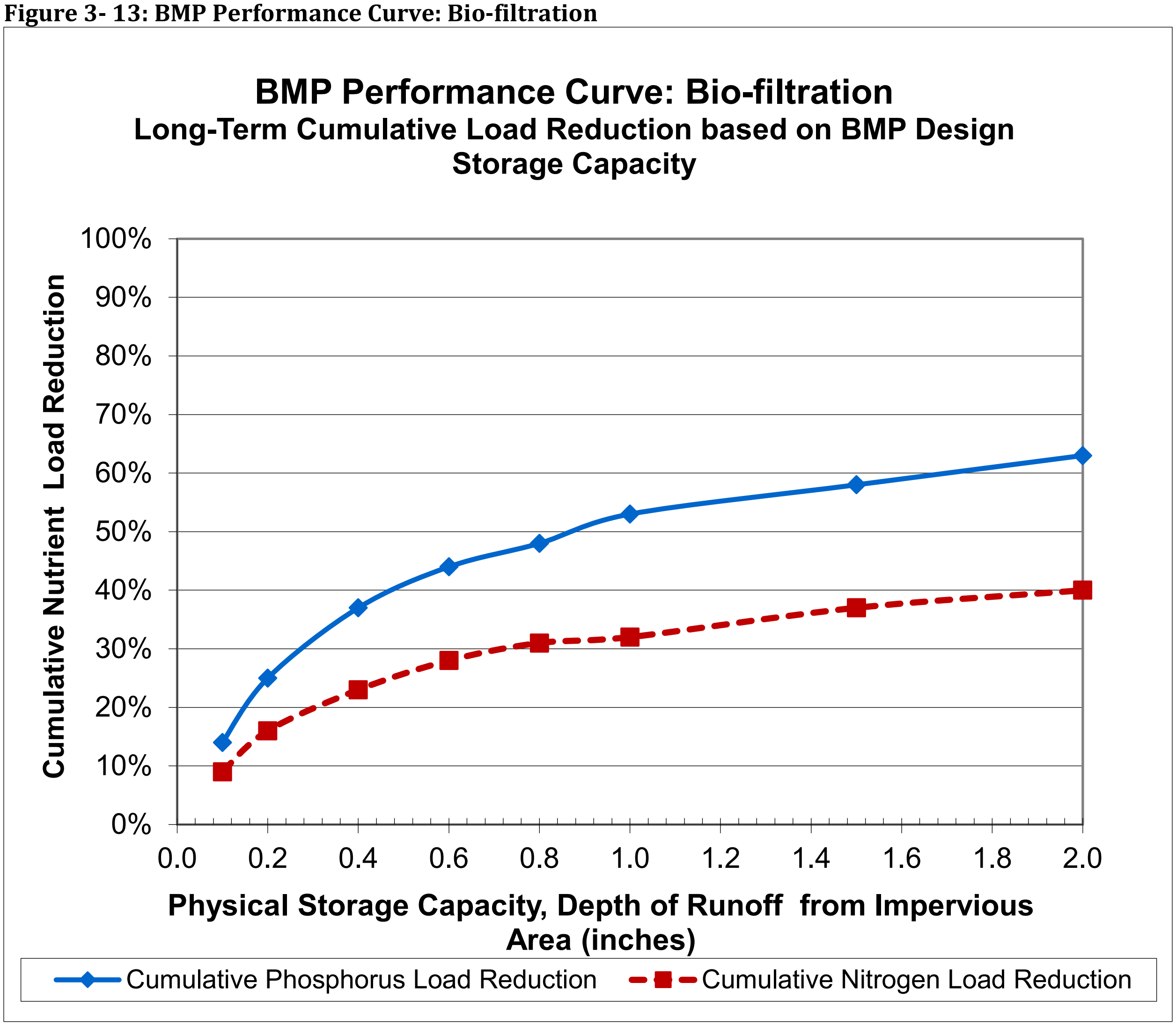


Table 3- 19: Gravel Wetland BMP Performance Table

Gravel Wetland BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	19%	26%	41%	51%	57%	61%	65%	66%
Cumulative Nitrogen Load Reduction	22%	33%	48%	57%	64%	68%	74%	79%

Figure 3- 14: BMP Performance Curve: Gravel Wetland

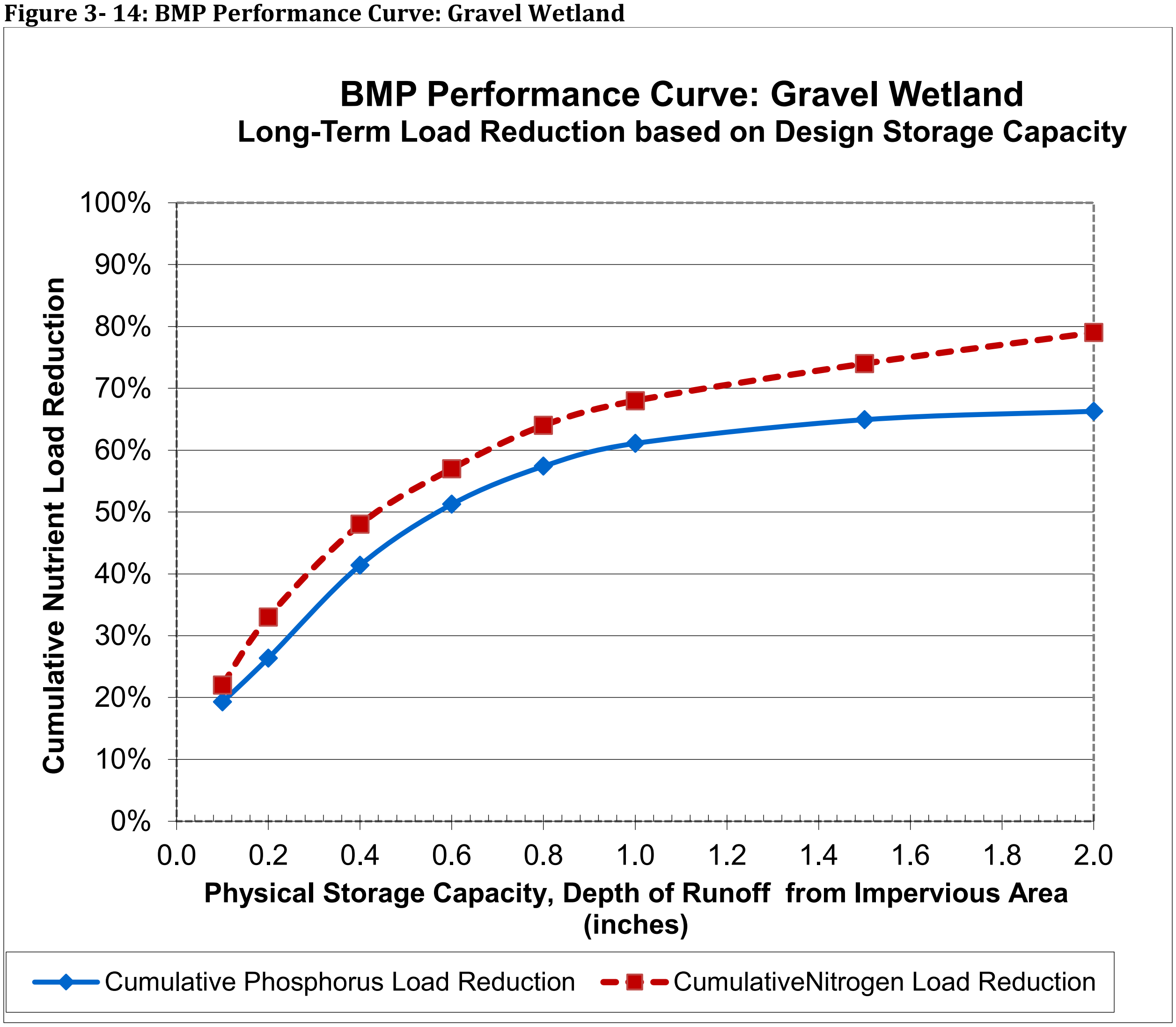


Table 3- 20: Enhanced Bio-filtration* with Internal Storage Reservoir (ISR) BMP Performance Table

Enhanced Bio-filtration* w/ ISR BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction

BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	19%	34%	53%	64%	71%	76%	84%	89%
Cumulative Nitrogen Load Reduction	32%	44%	58%	66%	71%	75%	82%	86%

***Filter media augmented with phosphorus sorbing materials to enhance phosphorus removal.**

Figure 3-15: BMP Performance Curve: Enhanced Bio-filtration with Internal Storage Reservoir (ISR) BMP Performance Table

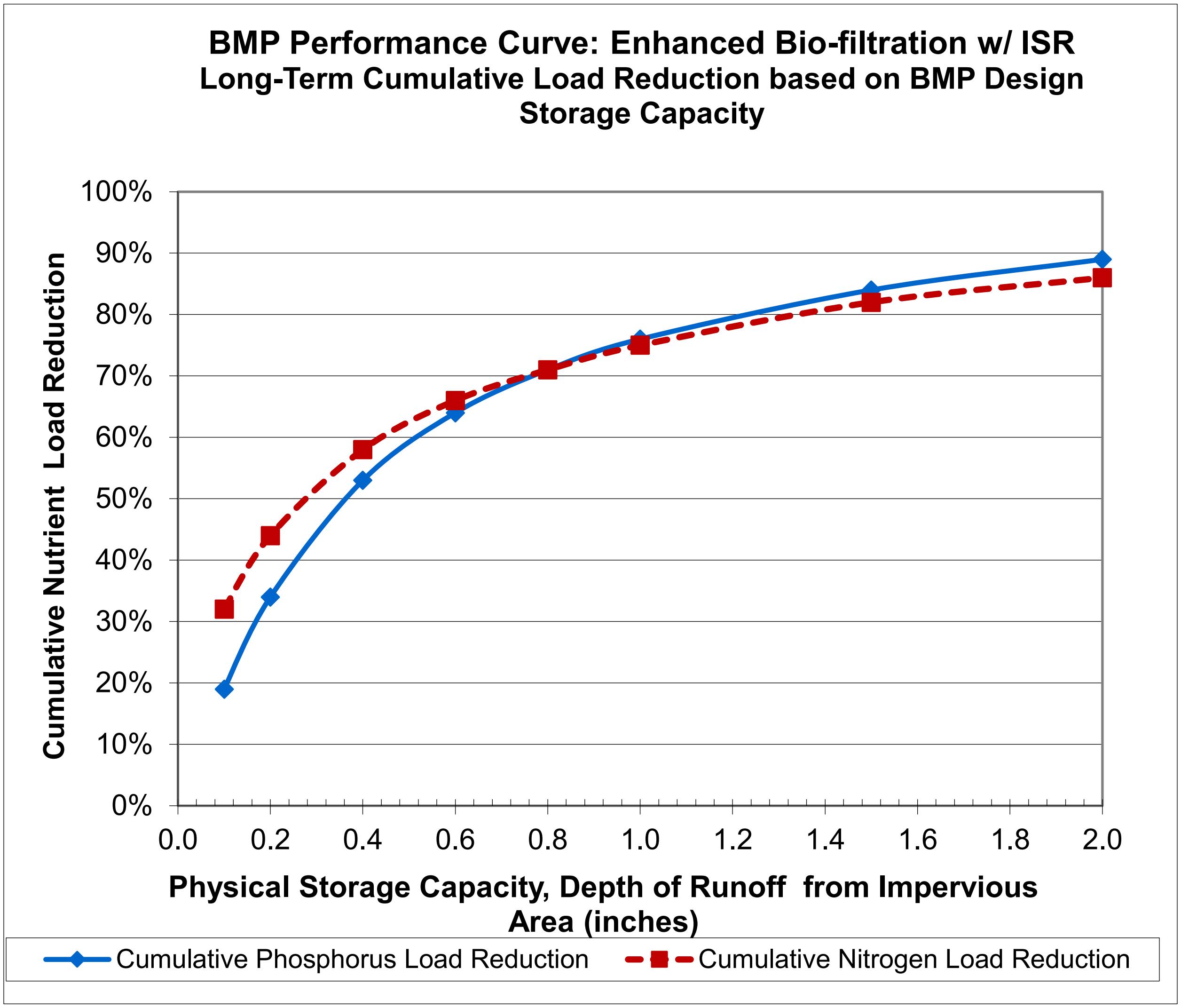


Table 3-21: Sand Filter BMP Performance Table

Sand Filter BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction

BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%

Figure 3-16: BMP Performance Curve: Sand Filter

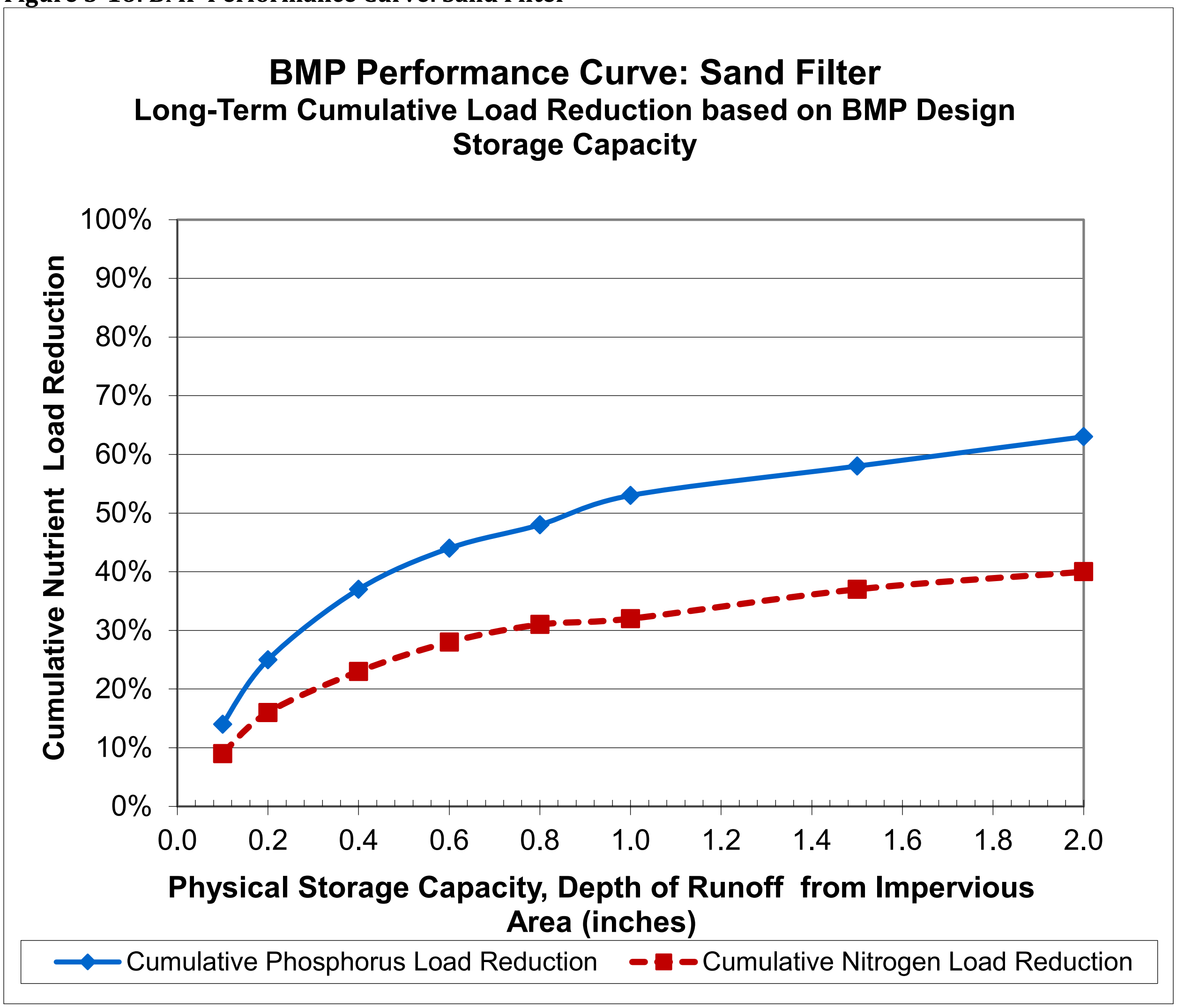


Table 3- 22 Porous Pavement BMP Performance Table

Porous Pavement BMP Performance Table: Long-Term Phosphorus Load Reduction

BMP Capacity: Depth of Filter Course Area (inches)	12.0	18.0	24.0	32.0
Cumulative Phosphorus Load Reduction	62%	70%	75%	78%
Cumulative Nitrogen Load Reduction	76%	77%	77%	79%

Figure 3- 17: BMP Performance Curve: Porous Pavement

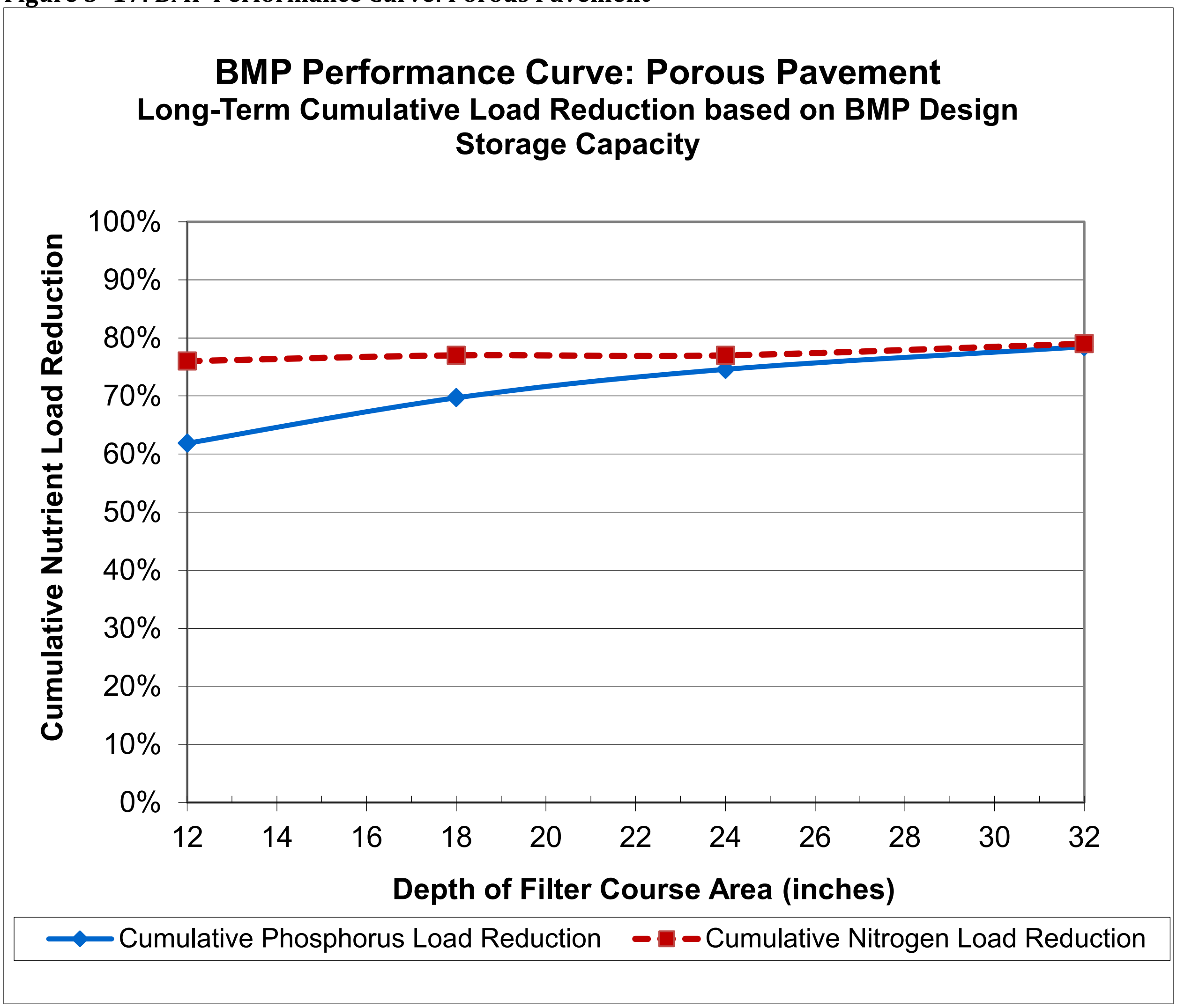


Table 3- 23: Wet Pond BMP Performance Table

Wet Pond BMP Performance Table: Long-Term Phosphorus Load Reduction

BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%

Figure 3-18: BMP Performance Curve: Wet Pond

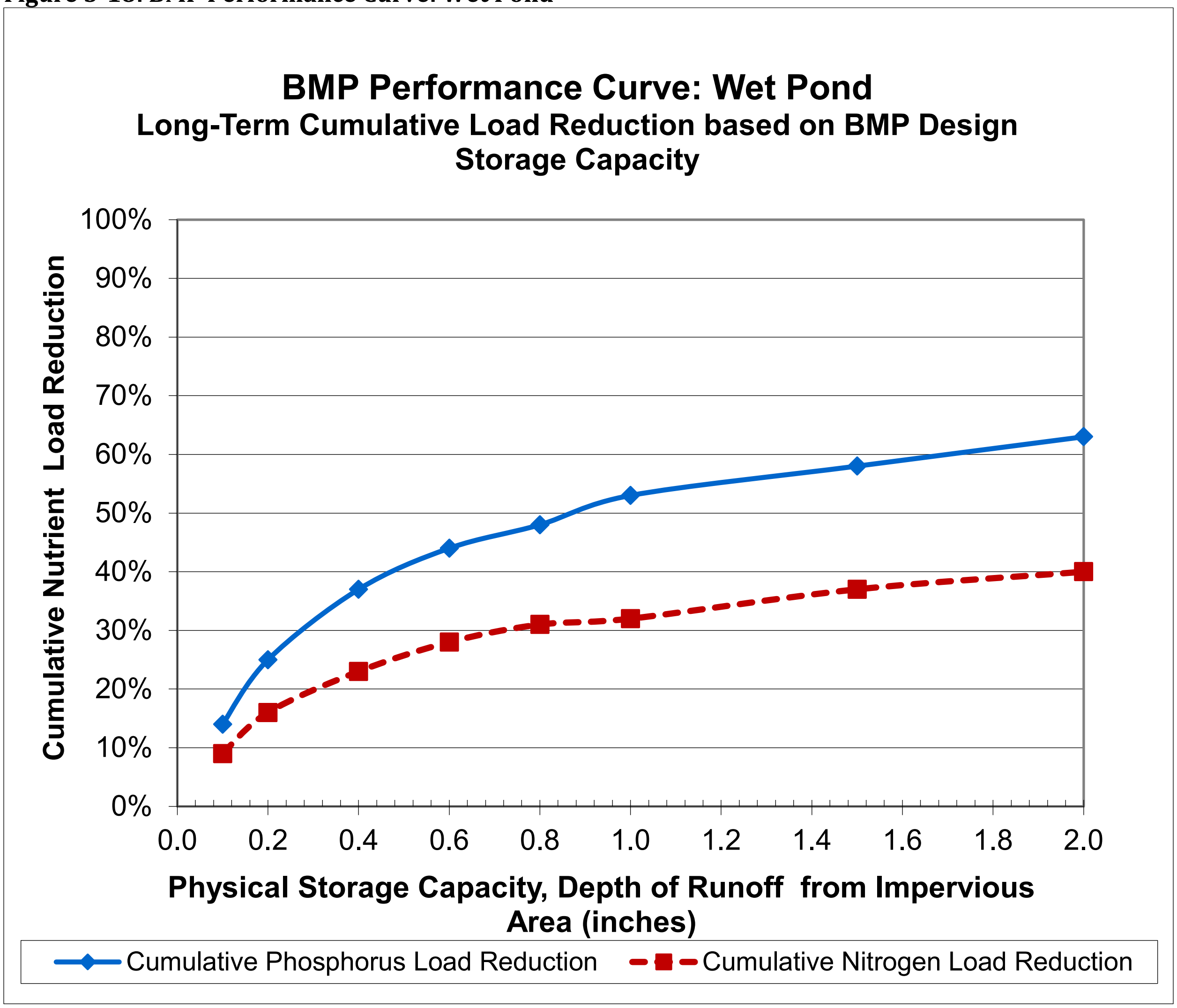


Table 3-24: Dry Pond BMP Performance Table

Extended Dry Pond BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction

BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	2%	5%	9%	13%	17%	21%	29%	36%
Cumulative Nitrogen Load Reduction	1%	3%	6%	9%	11%	13%	19%	23%

Figure 3- 19: BMP Performance Curve: Dry Pond

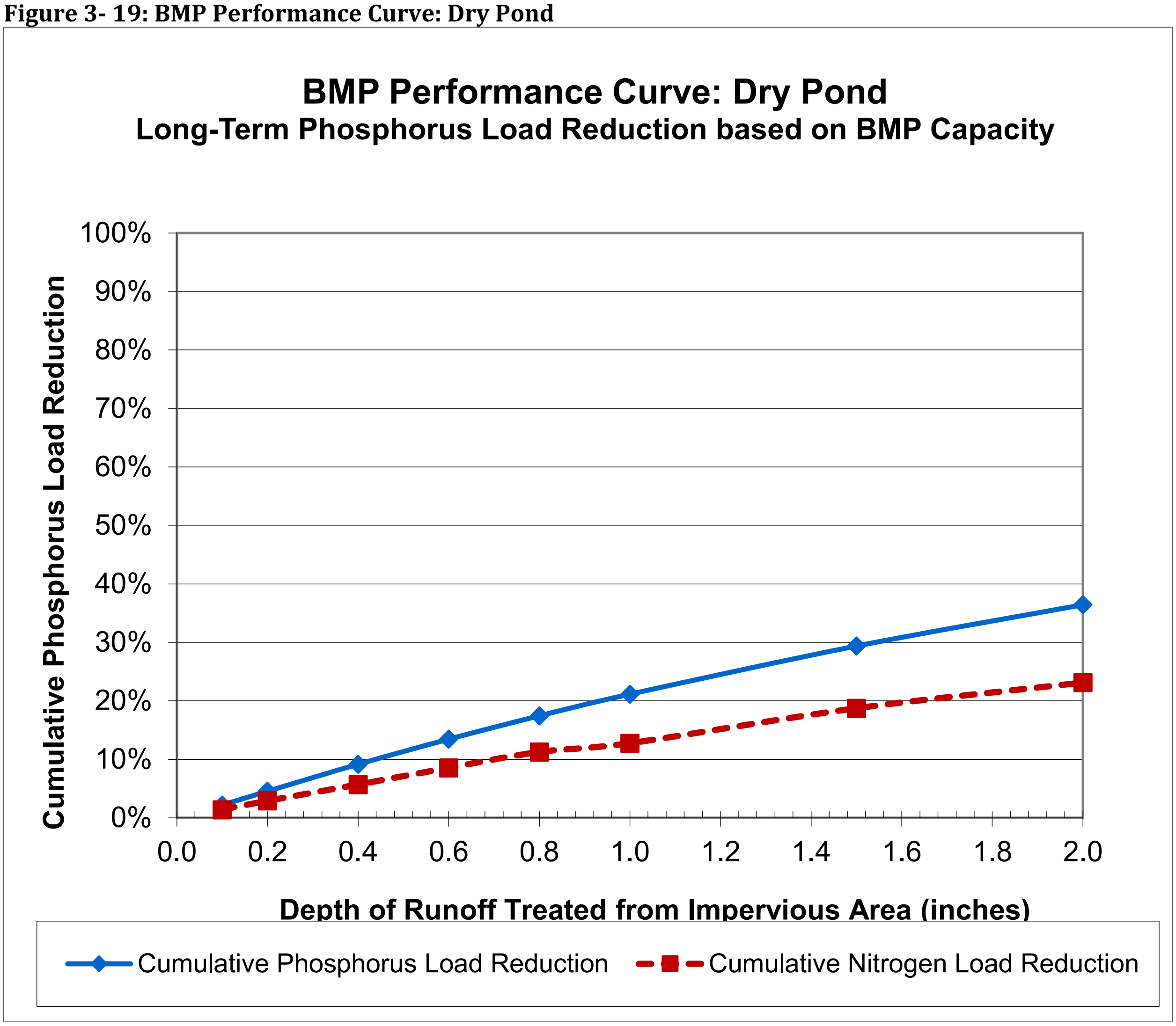


Table 3- 25: Water Quality Grass Swale with Detention BMP Performance Table

Water Quality Grass Swale with Detention Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction

BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Phosphorus Load Reduction	2%	5%	9%	13%	17%	21%	29%	36%
Nitrogen Load Reduction	1%	3%	6%	9%	11%	13%	19%	23%

Figure 3-20: BMP Performance Curve: Water Quality Grass Swale with Detention

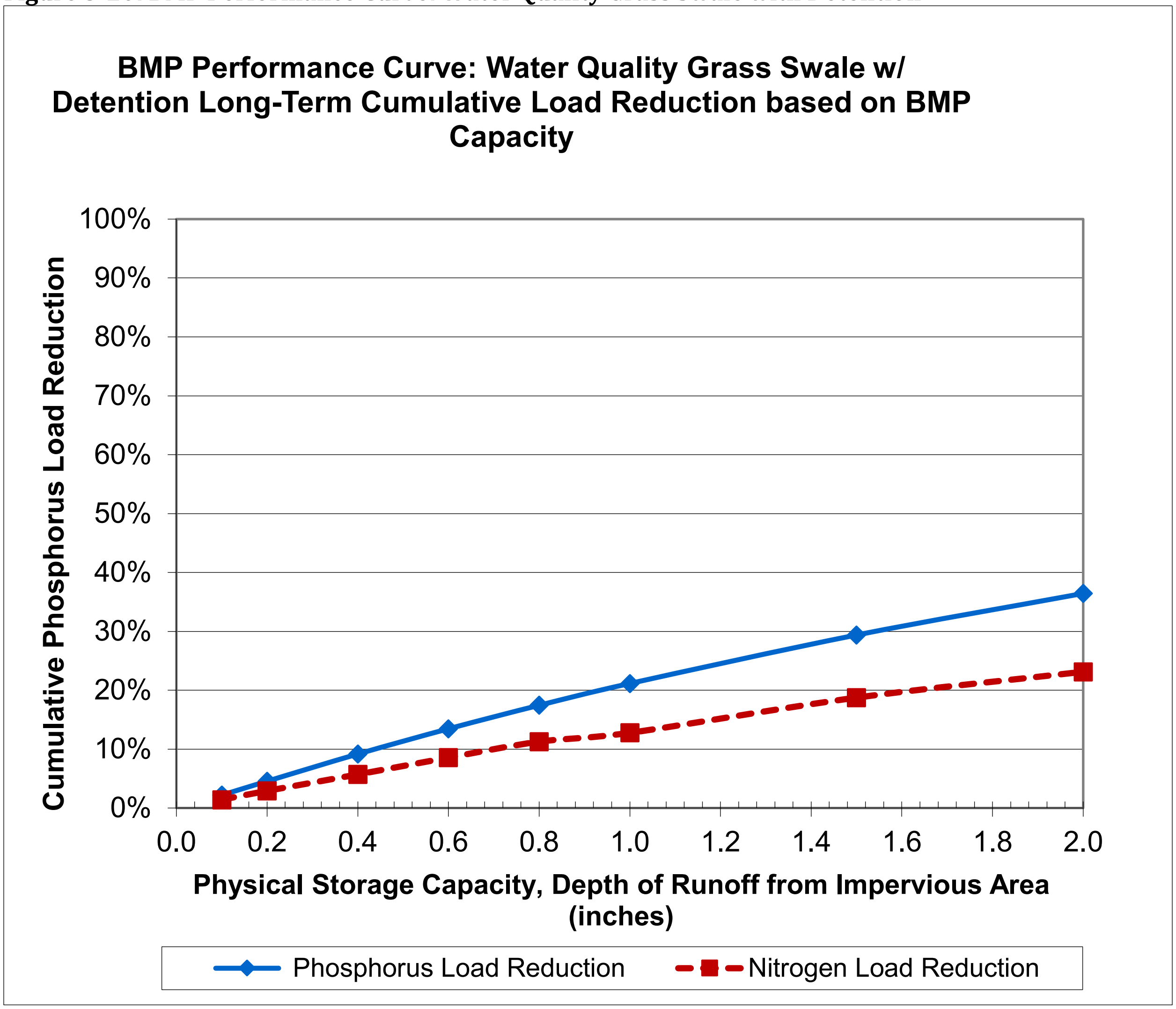


Table 3- 26: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1

Impervious Area Disconnection through Storage : Impervious Area to Pervious Area Ratio = 8:1	
	Total Runoff Volume (TP) Reduction Percentages

Storage volume to impervious area ratio	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	22%	22%	21%
0.2 in	40%	38%	37%	40%	38%	37%	37%	38%	37%	24%	26%	27%
0.3 in	52%	50%	49%	52%	50%	49%	40%	46%	49%	24%	26%	27%
0.4 in	61%	59%	58%	59%	59%	58%	40%	48%	54%	24%	26%	27%
0.5 in	67%	66%	64%	62%	66%	64%	40%	48%	56%	24%	26%	27%
0.6 in	70%	71%	70%	62%	70%	70%	40%	48%	56%	24%	26%	27%
0.8 in	71%	78%	77%	62%	73%	77%	40%	48%	56%	24%	26%	27%
1.0 in	71%	80%	80%	62%	73%	79%	40%	48%	56%	24%	26%	27%
1.5 in	71%	81%	87%	62%	73%	81%	40%	48%	56%	24%	26%	27%
2.0 in	71%	81%	88%	62%	73%	81%	40%	48%	56%	24%	26%	27%

Figure 3- 21: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG A Soils

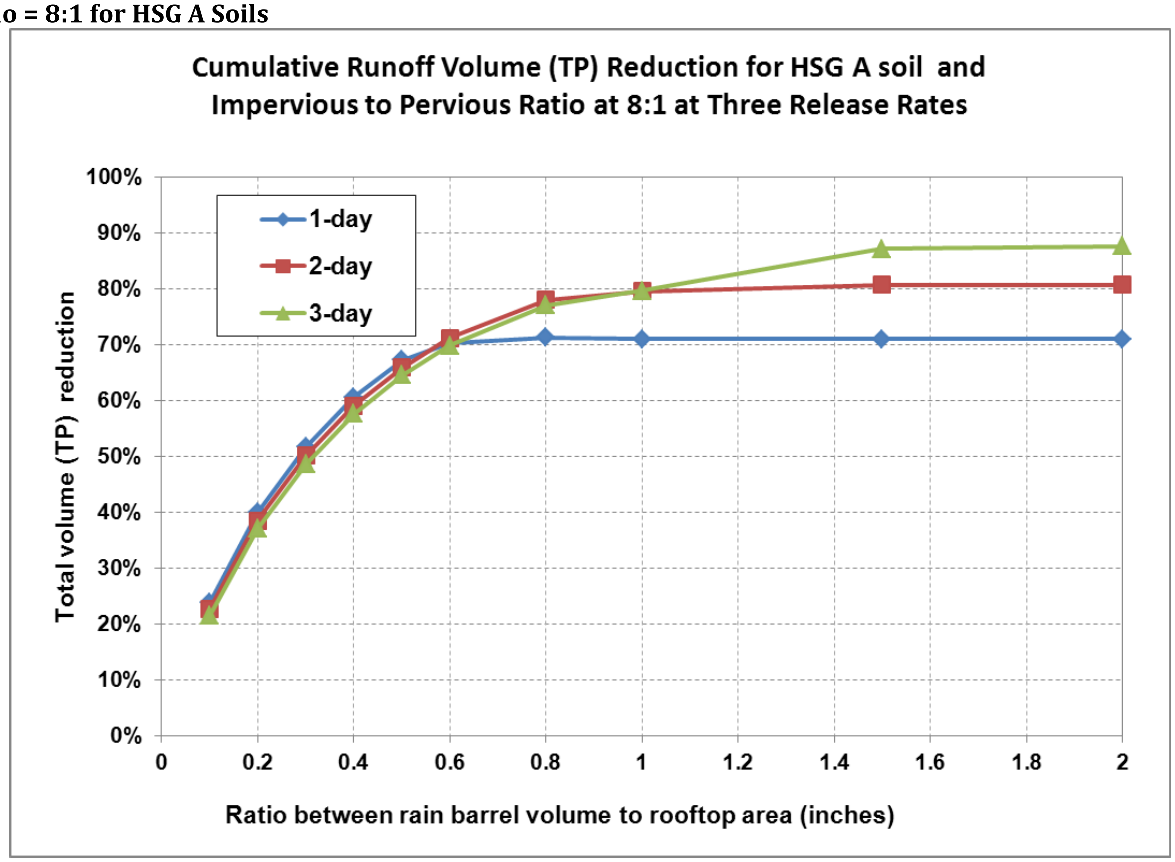


Figure 3- 22: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG B Soils

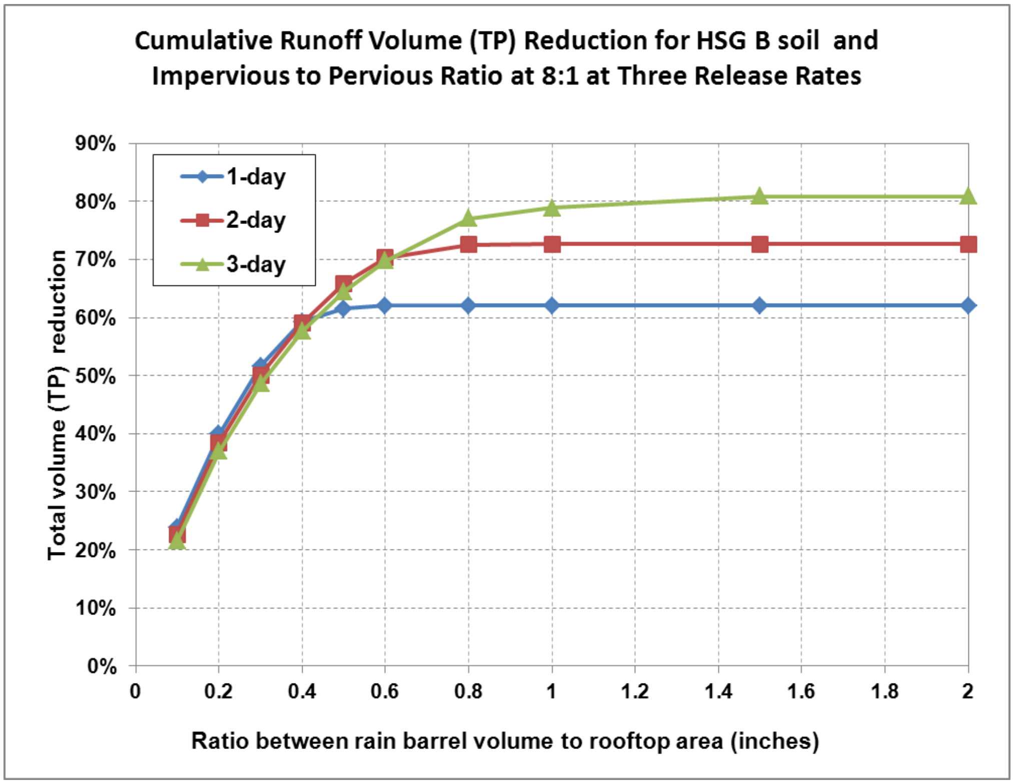


Figure 3- 23: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG C Soils

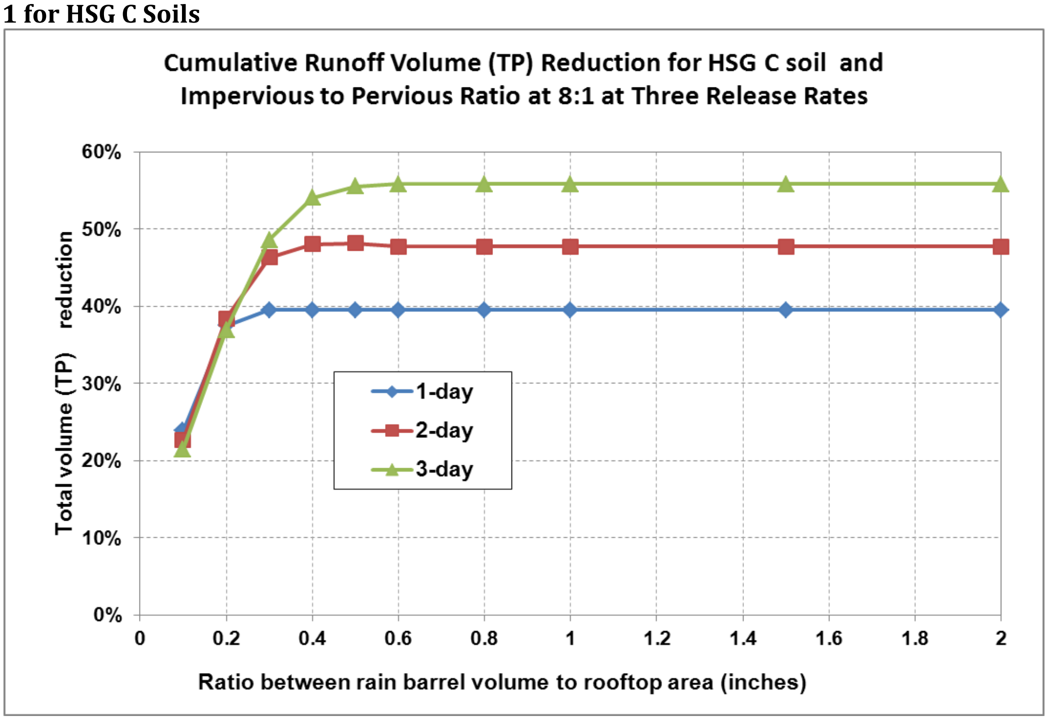


Figure 3- 24: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG D Soils

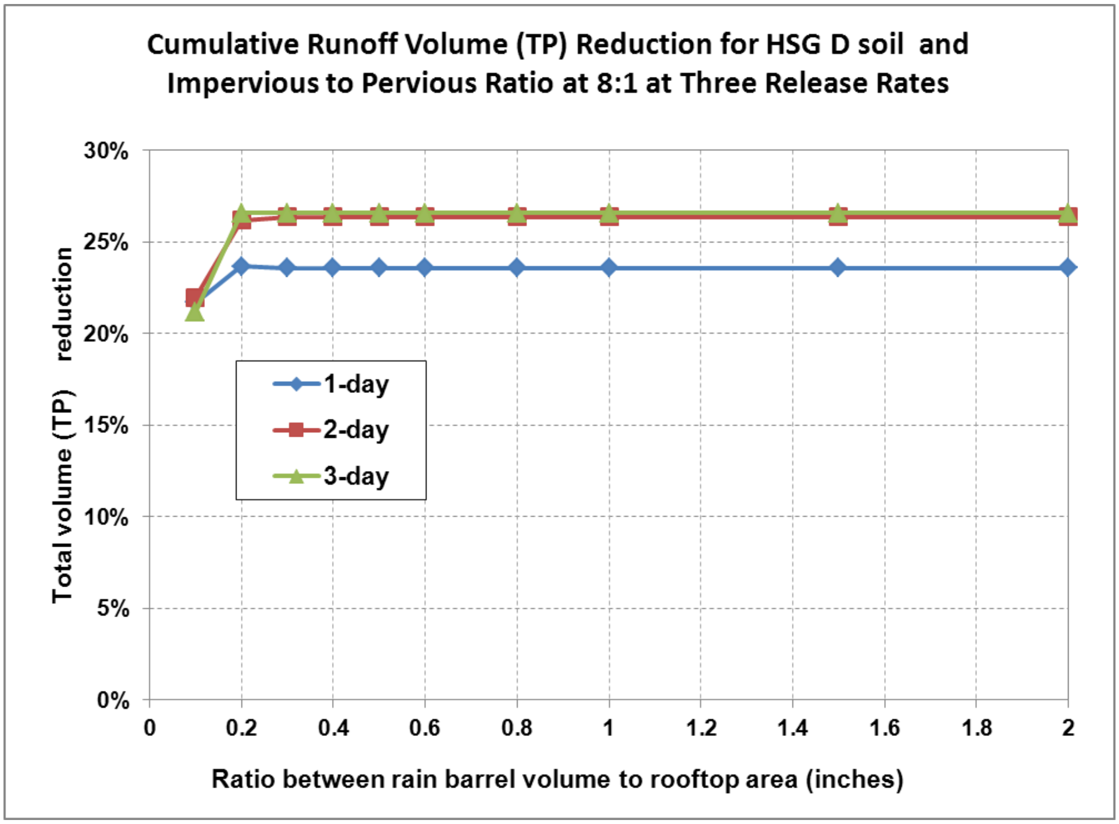


Table 3- 27: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1												
Rain barrel volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	23%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	28%	30%	33%
0.3 in	52%	50%	49%	52%	50%	49%	47%	50%	49%	29%	31%	34%
0.4 in	61%	59%	58%	61%	59%	58%	48%	55%	58%	29%	31%	34%
0.5 in	67%	66%	64%	67%	66%	64%	48%	57%	63%	29%	31%	34%
0.6 in	73%	71%	70%	70%	71%	70%	48%	57%	65%	29%	31%	34%
0.8 in	78%	78%	77%	71%	78%	77%	48%	57%	66%	29%	31%	34%
1.0 in	79%	81%	80%	71%	79%	80%	48%	57%	66%	29%	31%	34%
1.5 in	79%	87%	88%	71%	80%	87%	48%	57%	66%	29%	31%	34%
2.0 in	79%	87%	91%	71%	80%	87%	48%	57%	66%	29%	31%	34%

Figure 3- 25: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG A Soils

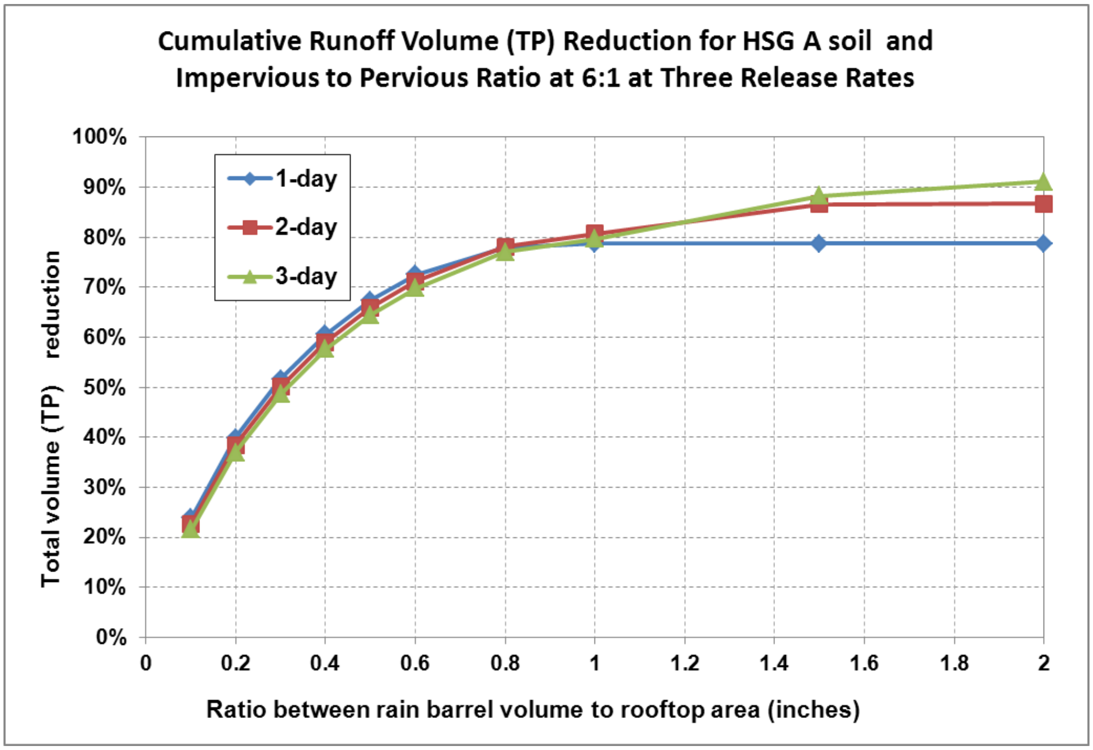


Figure 3- 26: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG B Soils

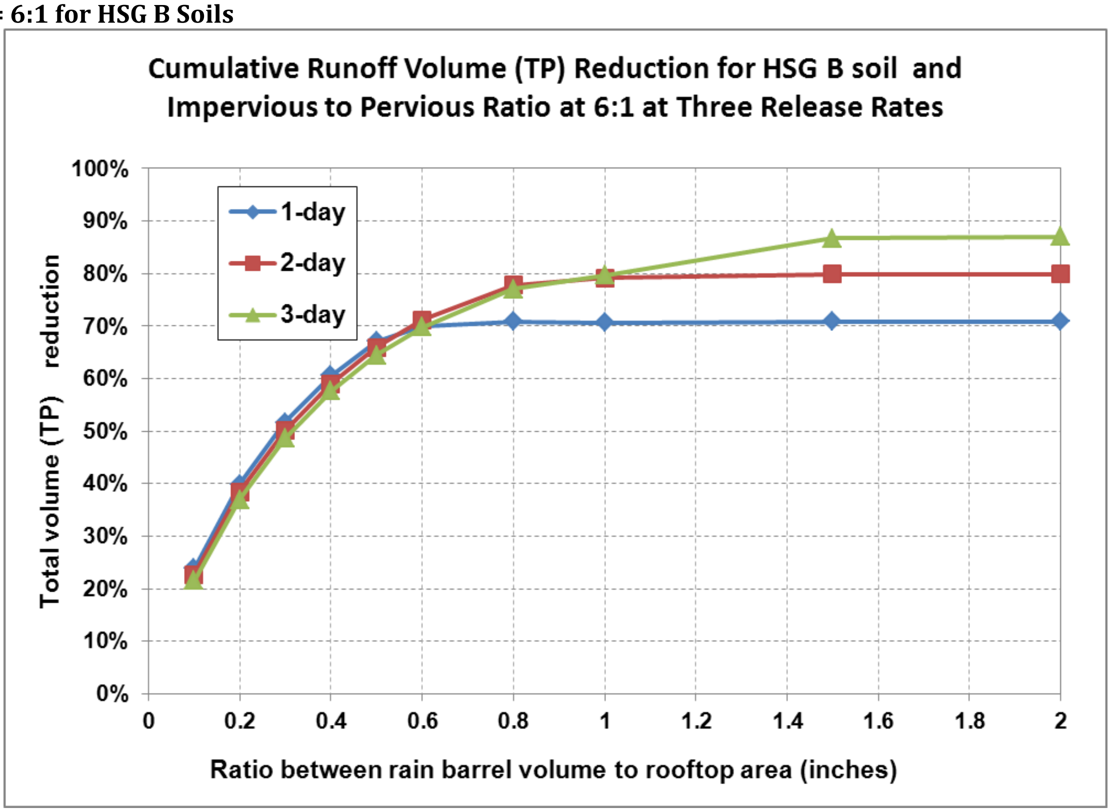


Figure 3- 27: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG C Soils

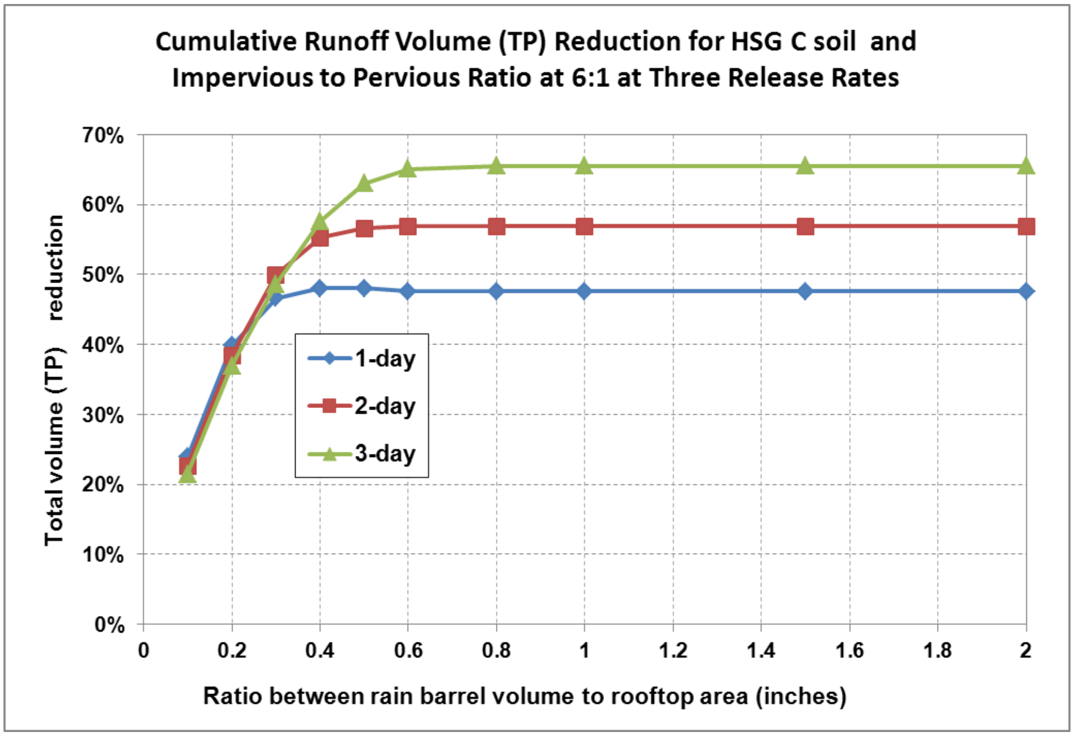


Figure 3- 28: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG D Soils

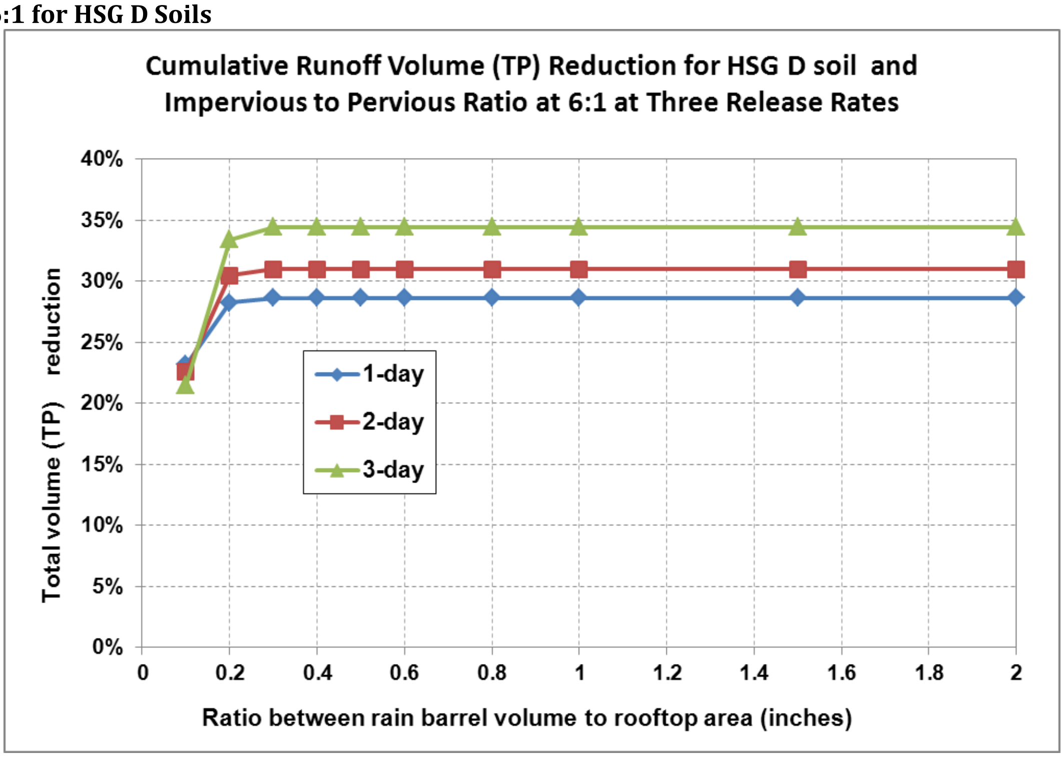


Table 3- 28: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1												
Storage volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	24%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	37%	37%	37%
0.3 in	52%	50%	49%	52%	50%	49%	52%	50%	49%	39%	42%	45%
0.4 in	61%	59%	58%	61%	59%	58%	58%	59%	58%	39%	42%	47%
0.5 in	67%	66%	64%	67%	66%	64%	60%	65%	64%	40%	42%	47%
0.6 in	73%	71%	70%	73%	71%	70%	61%	68%	70%	40%	42%	47%
0.8 in	79%	78%	77%	79%	78%	77%	61%	69%	75%	40%	42%	47%
1.0 in	82%	81%	80%	80%	81%	80%	61%	69%	76%	40%	42%	47%
1.5 in	87%	89%	88%	80%	87%	88%	61%	69%	76%	40%	42%	47%
2.0 in	87%	91%	91%	80%	88%	91%	61%	69%	76%	40%	42%	47%

Figure 3- 29: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG A Soils

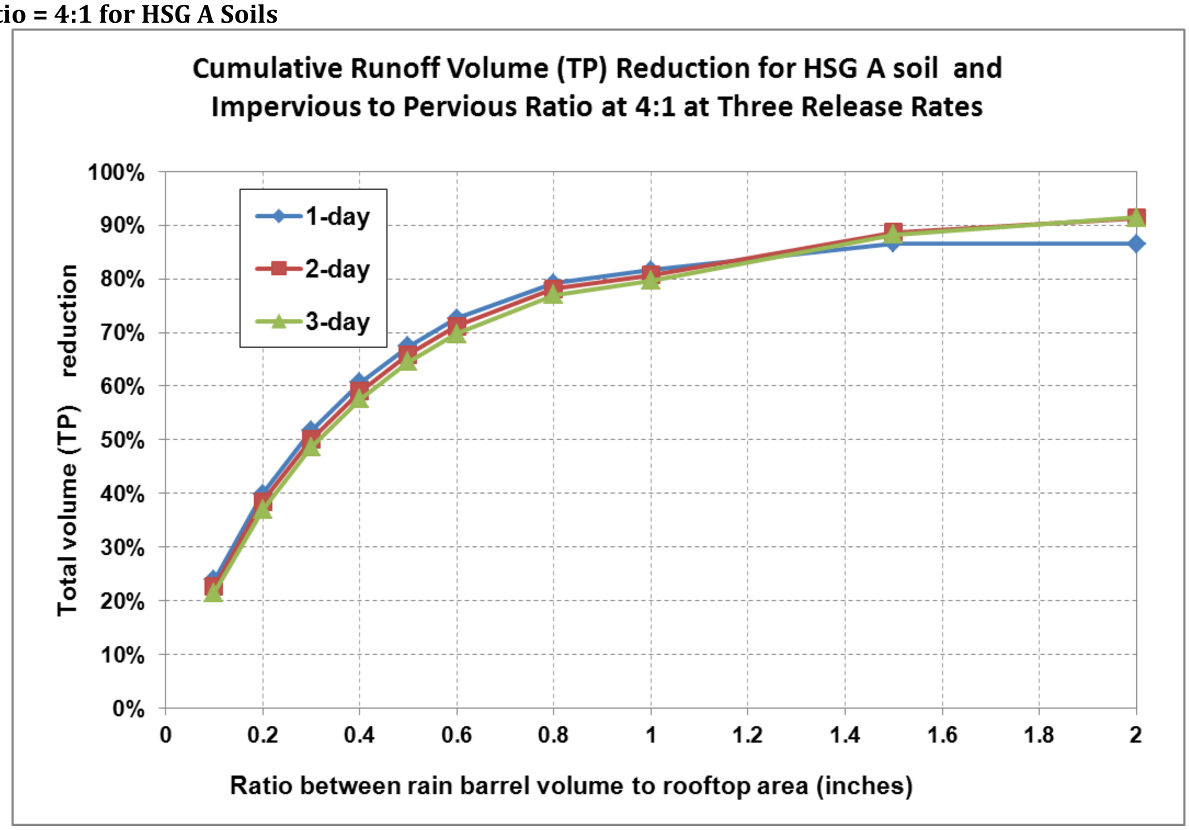


Figure 3- 30: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG B Soils

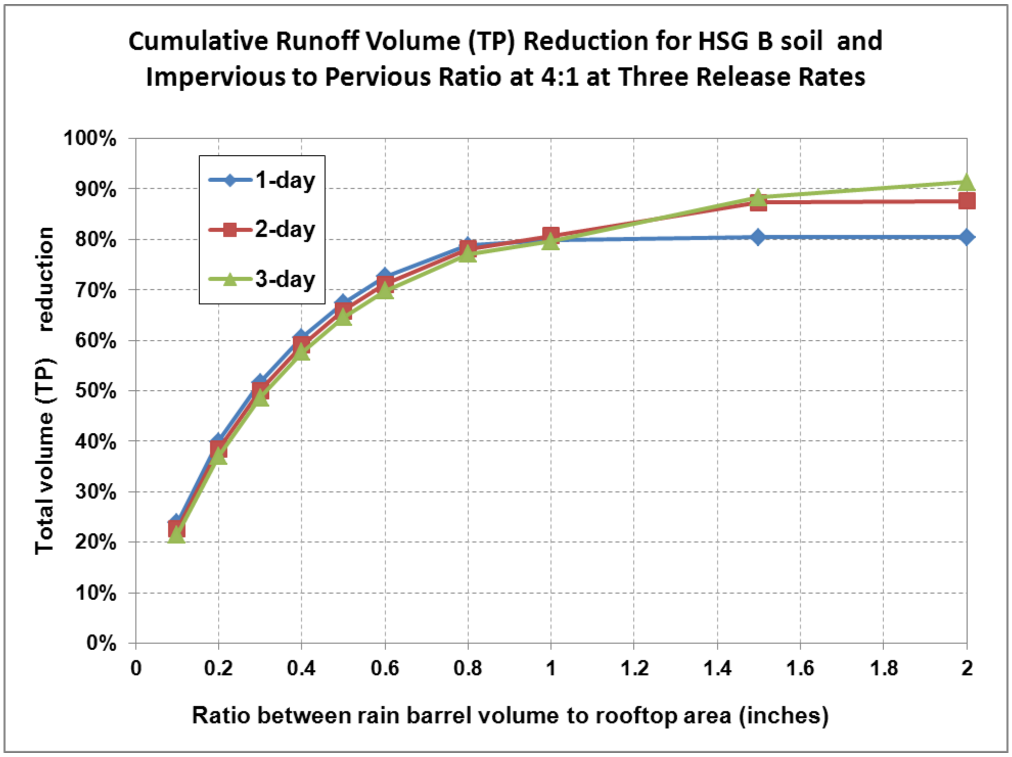


Figure 3- 31: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG C Soils

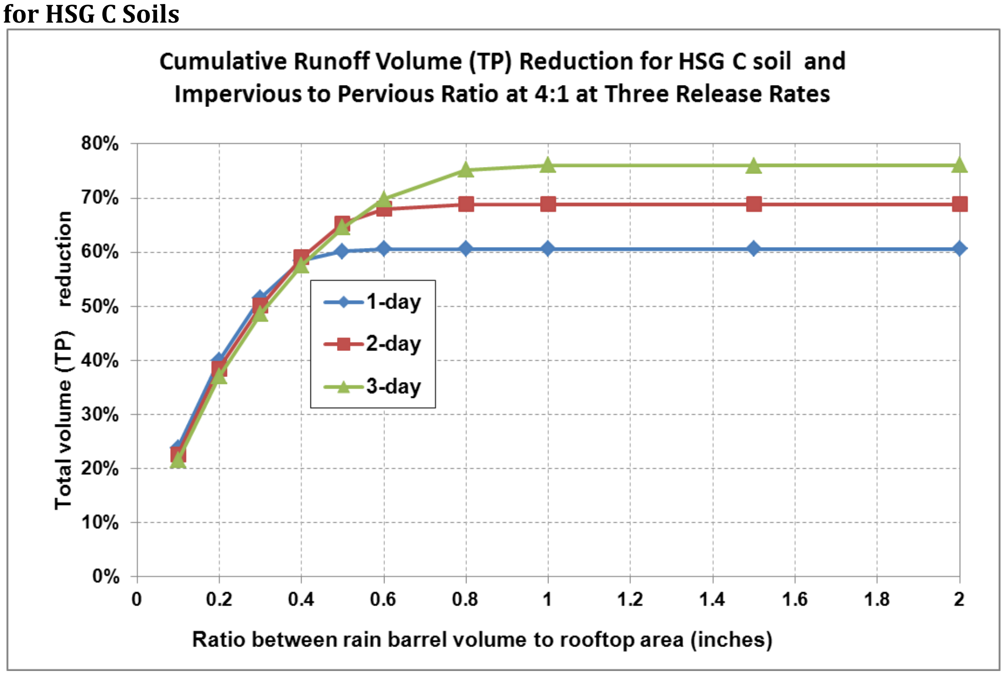


Figure 3- 32: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG D Soils

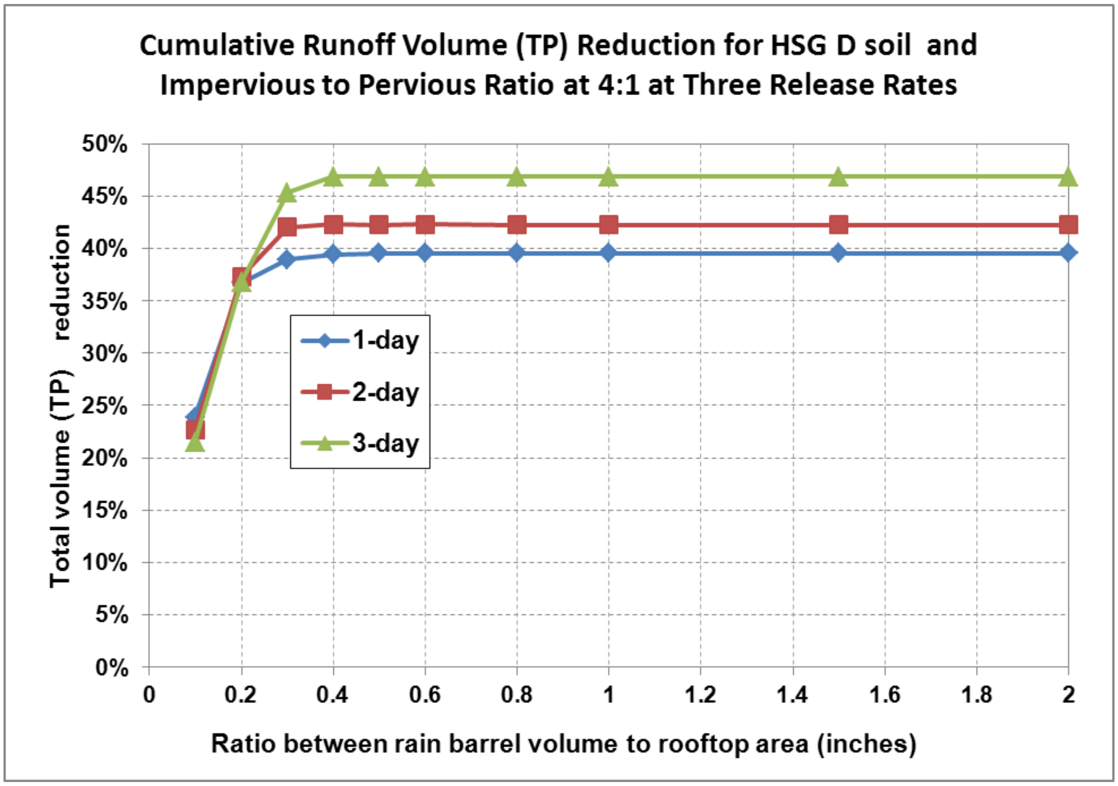


Table 3- 29: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 2:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 2:1												
Storage volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	24%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	40%	38%	37%
0.3 in	52%	50%	49%	52%	50%	49%	52%	50%	49%	51%	50%	49%
0.4 in	61%	59%	58%	61%	59%	58%	61%	59%	58%	57%	58%	57%
0.5 in	67%	66%	64%	67%	66%	64%	67%	66%	64%	59%	62%	63%
0.6 in	73%	71%	70%	73%	71%	70%	72%	71%	70%	59%	62%	67%
0.8 in	79%	78%	77%	79%	78%	77%	77%	78%	77%	59%	62%	67%
1.0 in	82%	81%	80%	82%	81%	80%	78%	81%	80%	59%	62%	67%
1.5 in	89%	89%	88%	89%	89%	88%	78%	84%	88%	59%	62%	67%
2.0 in	92%	92%	91%	91%	92%	91%	78%	84%	89%	59%	62%	67%

Figure 3- 33: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG A Soils

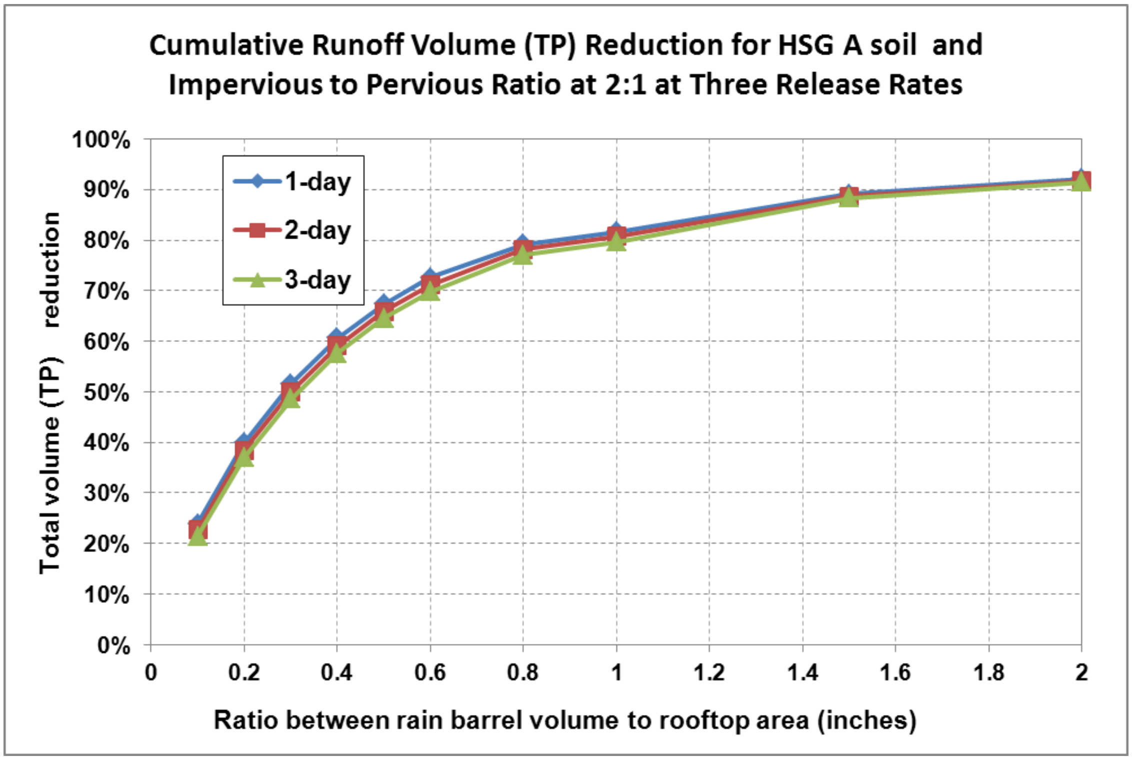


Figure 3- 34: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG B Soils

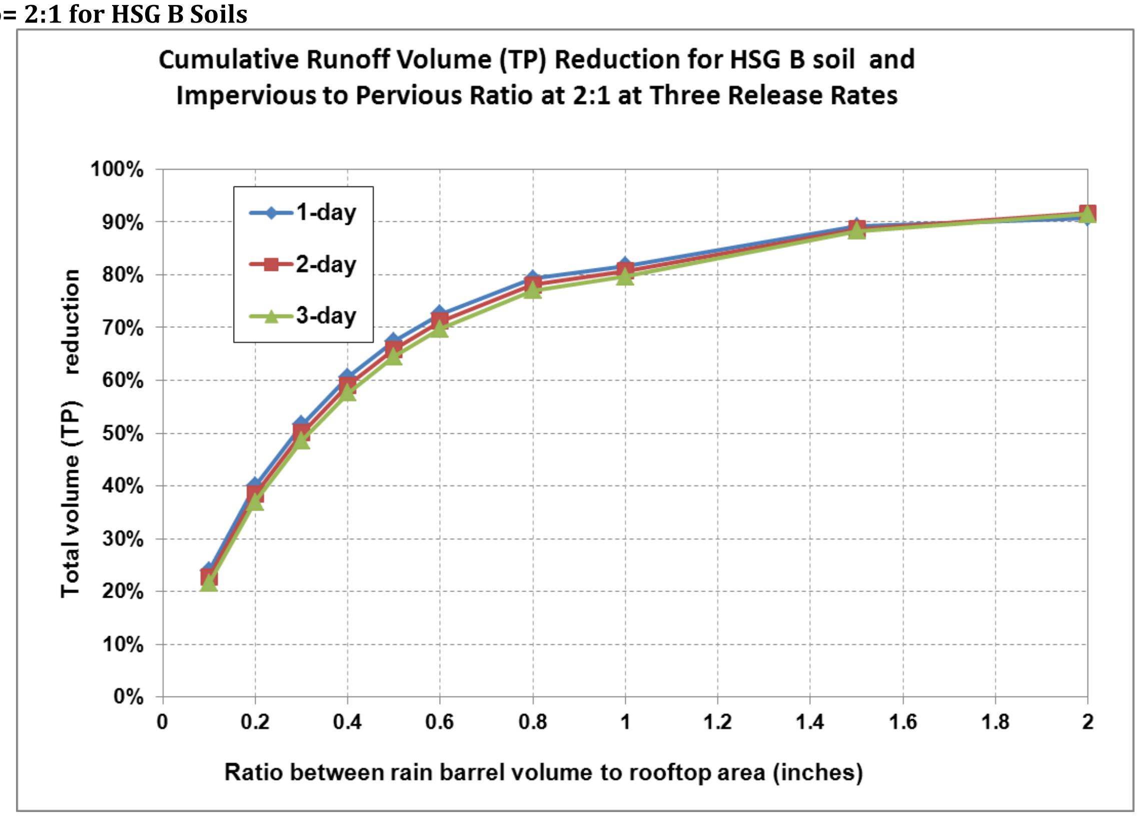


Figure 3- 35: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG C Soils

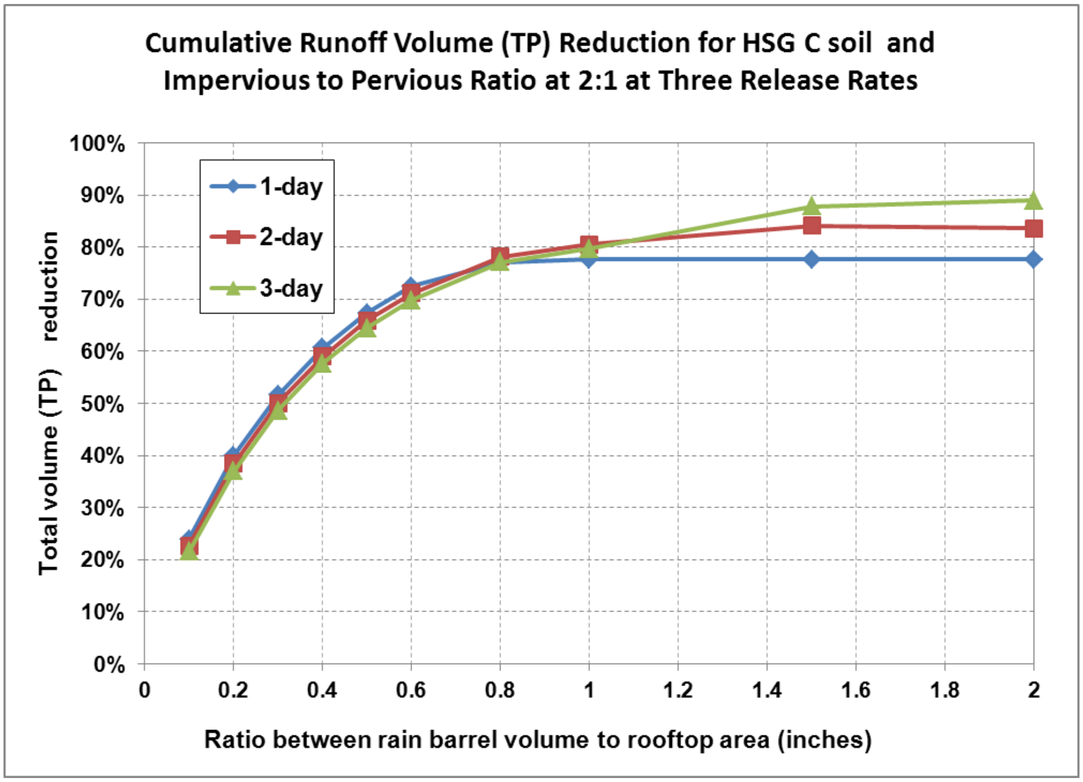


Figure 3- 36: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG D Soils

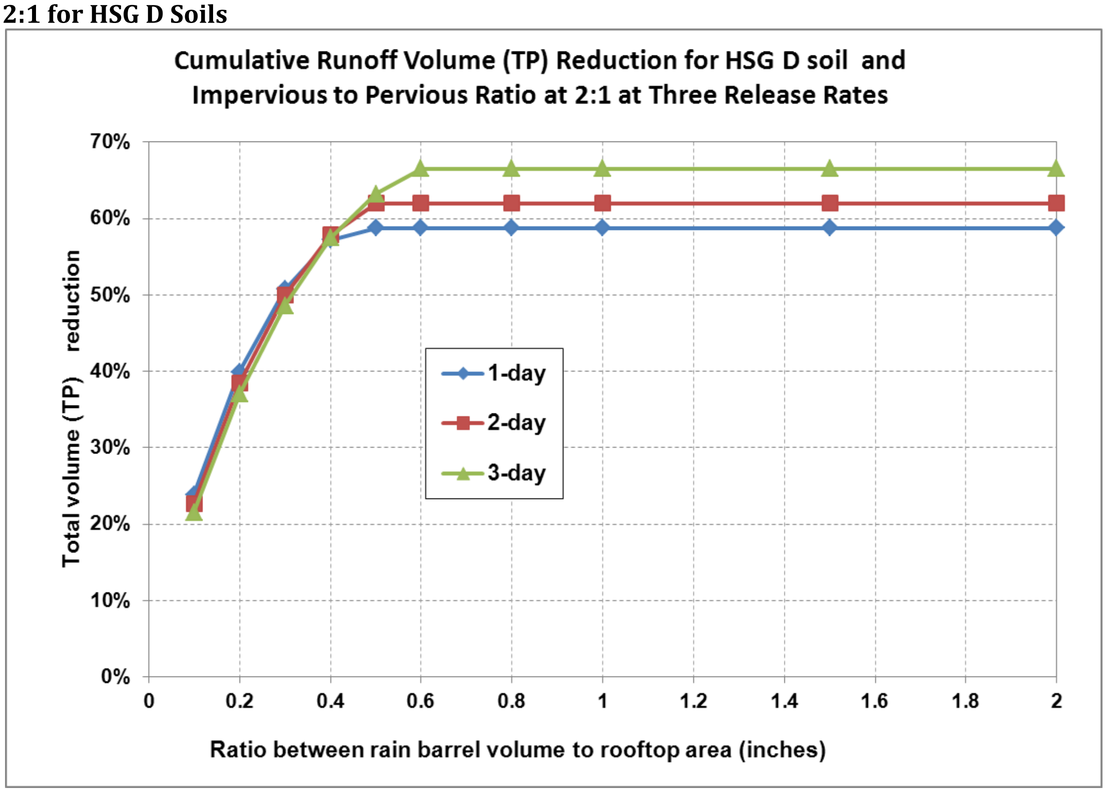


Table 3- 30: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1												
Storage volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	24%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	40%	38%	37%
0.3 in	52%	50%	49%	52%	50%	49%	52%	50%	49%	52%	50%	49%
0.4 in	61%	59%	58%	61%	59%	58%	61%	59%	58%	61%	59%	58%
0.5 in	67%	66%	64%	67%	66%	64%	67%	66%	64%	67%	66%	64%
0.6 in	73%	71%	70%	73%	71%	70%	73%	71%	70%	72%	71%	70%
0.8 in	79%	78%	77%	79%	78%	77%	79%	78%	77%	78%	78%	77%
1.0 in	82%	81%	80%	82%	81%	80%	82%	81%	80%	79%	80%	80%
1.5 in	89%	89%	88%	89%	89%	88%	89%	89%	88%	80%	82%	86%
2.0 in	92%	92%	91%	92%	92%	91%	91%	92%	91%	80%	82%	86%

Figure 3- 37: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG A Soils

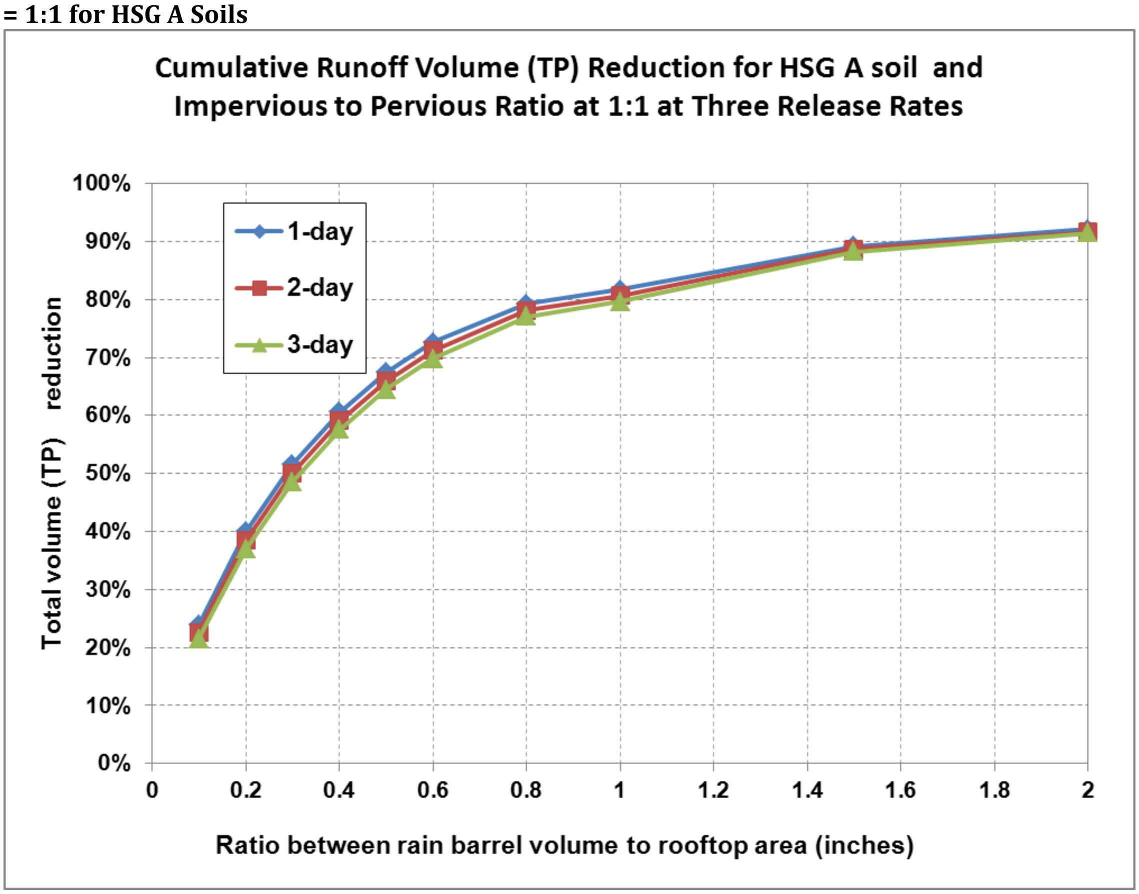


Figure 3- 38: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG B Soils

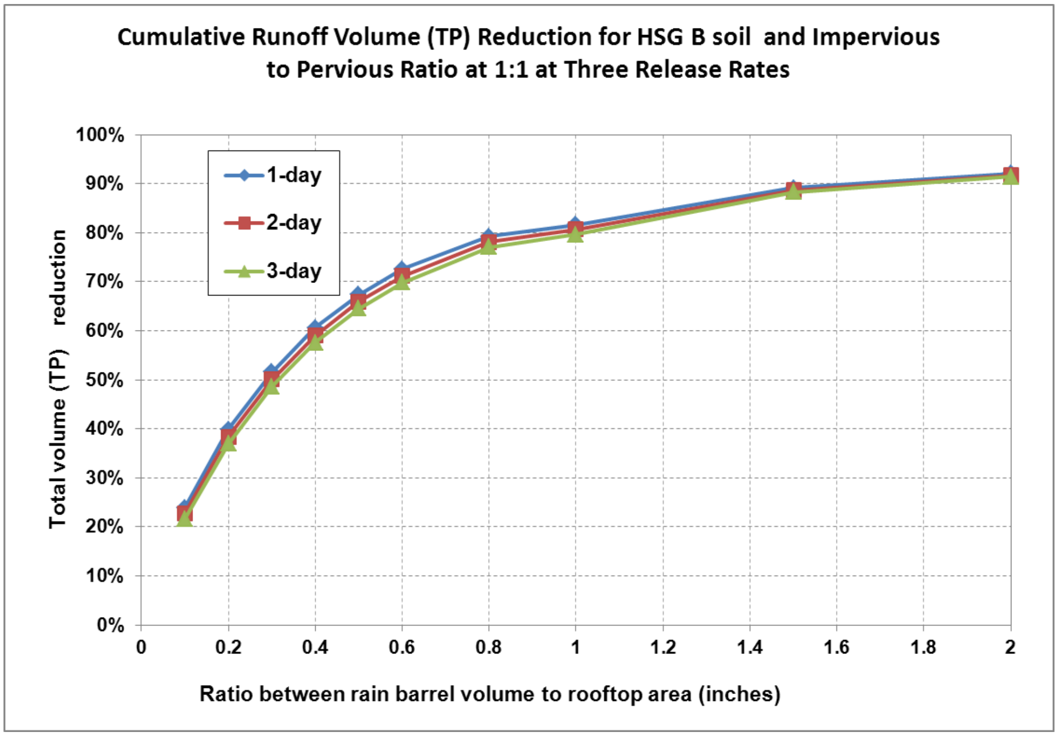


Figure 3- 39: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG C Soils

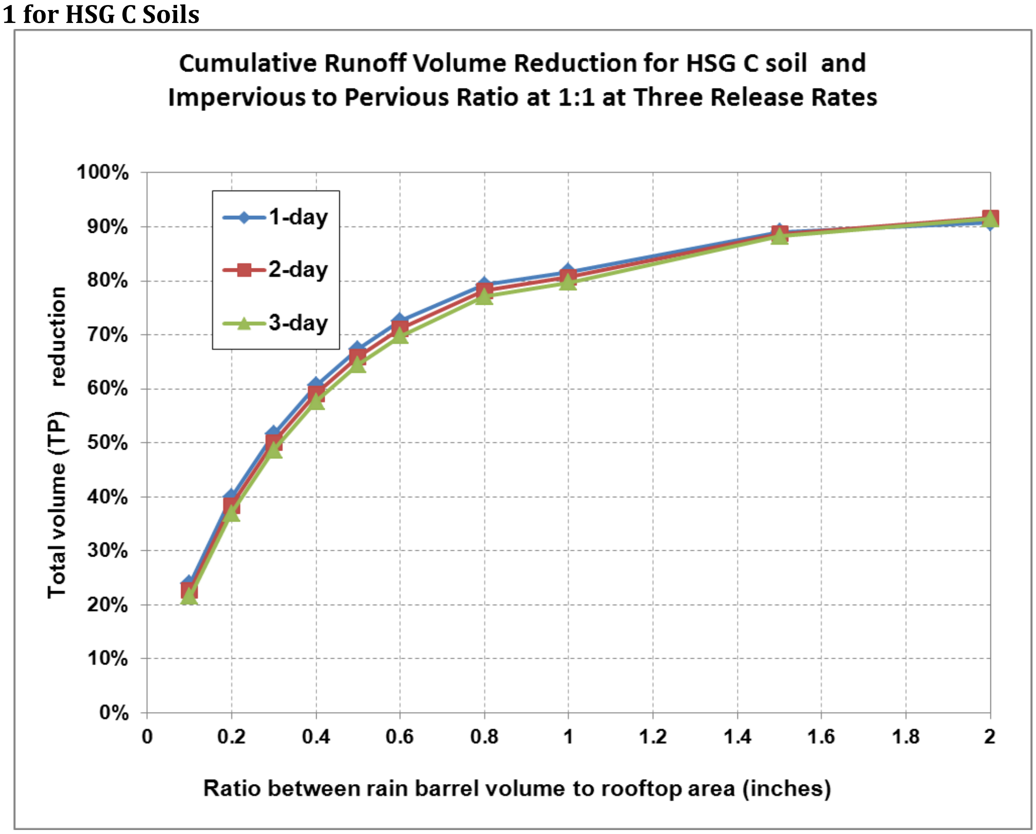


Figure 3- 40: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG D Soils

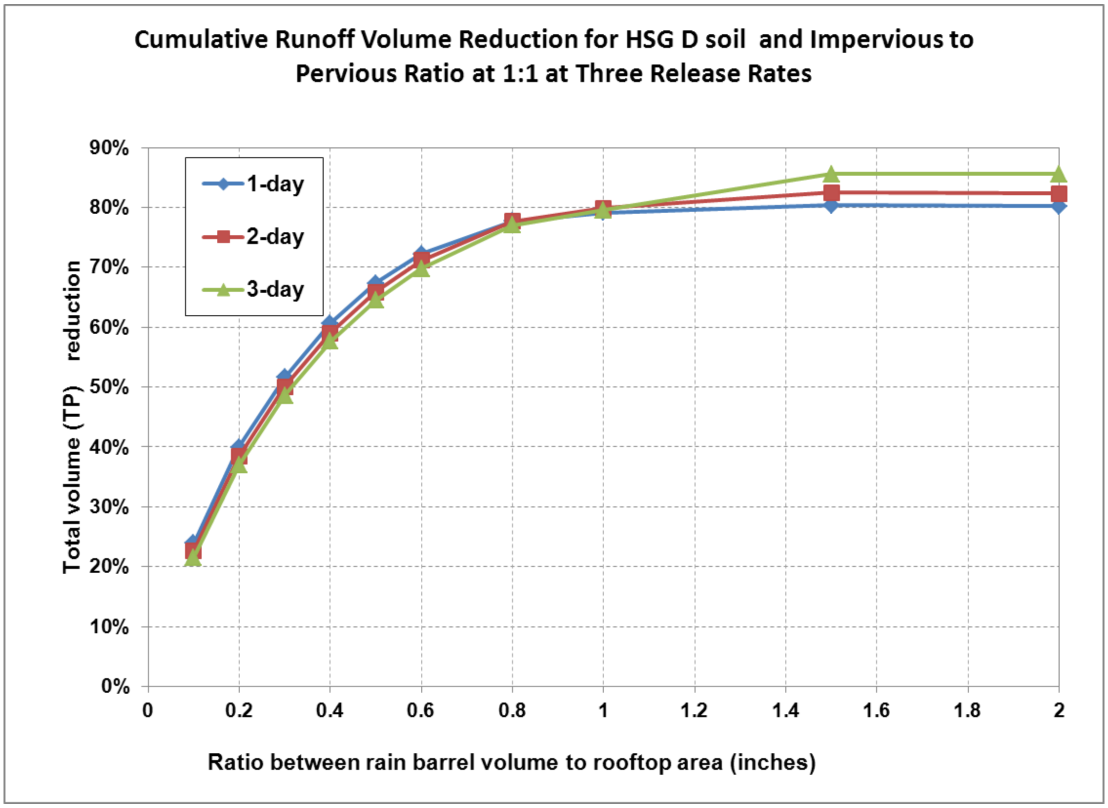


Table 3- 31: Impervious Area Disconnection Performance Table

Impervious area to pervious area ratio	Soil type of Receiving Pervious Area			
	HSG A	HSG B	HSG C	HSG D
8:1	30%	14%	7%	3%
6:1	37%	18%	11%	5%
4:1	48%	27%	17%	9%
2:1	64%	45%	33%	21%
1:1	74%	59%	49%	36%
1:2	82%	67%	60%	49%
1:4	85%	72%	67%	57%

Figure 3- 41: Impervious Area Disconnection Performance Curves

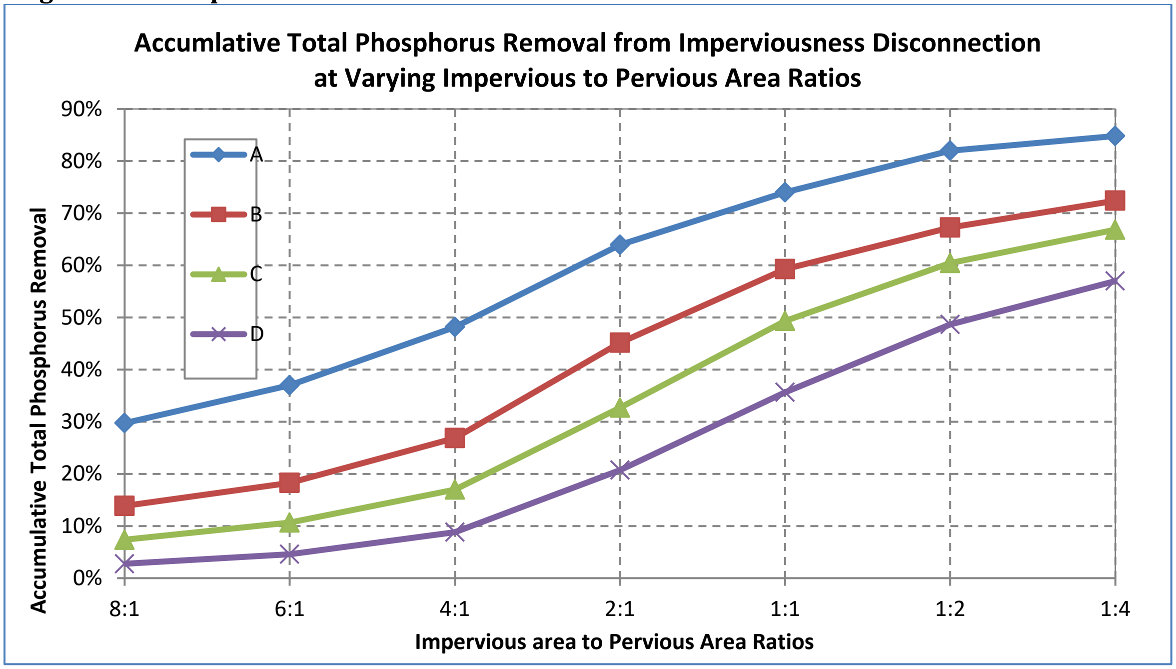


Table 3- 32: Performance Table for Conversion of Impervious Areas to Pervious Area based on Hydrological Soil Groups

Land-Use Group	Cumulative Reduction in Annual Stormwater Phosphorus Load				
	Conversion of impervious area to pervious area-HSG A	Conversion of impervious area to pervious area-HSG B	Conversion of impervious area to pervious area-HSG C	Conversion of impervious area to pervious area-HSG C/D	Conversion of impervious area to pervious area-HSG D
Commercial (Com) and Industrial (Ind)	98.5%	93.5%	88.0%	83.5%	79.5%
Multi-Family (MFR) and High-Density Residential (HDR)	98.8%	95.0%	90.8%	87.3%	84.2%
Medium -Density Residential (MDR)	98.6%	94.1%	89.1%	85.0%	81.4%
Low Density Residential (LDR) - "Rural"	98.2%	92.4%	85.9%	80.6%	75.9%
Highway (HWY)	98.0%	91.3%	84.0%	78.0%	72.7%
Forest (For)	98.2%	92.4%	85.9%	80.6%	75.9%
Open Land (Open)	98.2%	92.4%	85.9%	80.6%	75.9%
Agriculture (Ag)	70.6%	70.6%	70.6%	70.6%	70.6%

Table 3- 33: Performance Table for Conversion of Low Permeable Pervious Area to High Permeable Pervious Area based on Hydrological Soil Group

Land Cover	Cumulative Reduction in Annual SW Phosphorus Load from Pervious Area				
	Conversion of pervious area HSG D to pervious area-HSG A	Conversion of pervious area HSG D to pervious area-HSG B	Conversion of pervious area HSG D to pervious area-HSG C	Conversion of pervious area HSG C to pervious area-HSG A	Conversion of pervious area HSG C to pervious area-HSG B
Developed Pervious Land	92.7%	68.3%	41.5%	83.5%	79.5%

APPENDIX H

Requirements Related to Discharges to Certain Water Quality Limited Waterbodies

Table of Contents

I. <u>Discharges to water quality limited waterbodies and their tributaries where nitrogen is the cause of the impairment</u>

1. Part 2.2.2.a.i. of the permit identifies the permittees subject to additional requirements to address nitrogen in their stormwater discharges because they discharge to waterbodies that are water quality limited due to nitrogen, or their tributaries, without an EPA approved TMDL. Permittees identified in Part 2.2.2.a.i of the permit must identify and implement BMPs designed to reduce nitrogen discharges in the impaired catchment(s). To address nitrogen discharges each permittee shall comply with the following requirements:

    a. Additional or Enhanced BMPs

        i. The permittee remains subject to all the requirements of Part 2.3. of the permit and shall include the following enhancements to the BMPs required by Part 2.3 of the permit:

            1. Part 2.3.2, Public Education and Outreach: The permittee shall replace its Residential and Business/Commercial/Institution program with annual timed messages on specific topics, at a minimum. The permittee shall distribute an annual message in the spring (April/May) timeframe that encourages the proper use and disposal of grass clippings and encourages the proper use of slow-release fertilizers. The permittee shall distribute an annual message in the summer (June/July) timeframe encouraging the proper management of pet waste, including noting any existing ordinances where appropriate. The permittee shall distribute an annual message in the Fall (August/September/October) timeframe encouraging the proper disposal of leaf litter. The permittee shall deliver an annual message on each of these topics, unless the permittee determines that one or more of these issues is not a significant contributor of nitrogen to discharges from the MS4 and the permittee retains documentation of this finding in the SWMP.

            2. Part 2.3.6, Stormwater Management in New Development and Redevelopment: the requirement for adoption/amendment of the permittee's ordinance or other regulatory mechanism shall include a requirement that new development and redevelopment stormwater management BMPs be optimized for nitrogen removal; retrofit inventory and priority ranking under 2.3.6.e shall include consideration of BMPs to reduce nitrogen discharges.

            3. Part 2.3.7, Good House Keeping and Pollution Prevention for Permittee Owned Operations: establish requirements for use of slow release fertilizers on permittee owned property currently using fertilizer, in addition to reducing and managing fertilizer use as provided in 2.3.7.1; establish procedures to properly manage grass cuttings and leaf litter on permittee property, including prohibiting blowing organic waste materials onto adjacent impervious surfaces; increased street sweeping frequency of all municipal owned streets and parking lots to a minimum of two times per year, once in the spring (following winter activities such as sanding) and at least once in the fall (following leaf fall). Permittees

may also choose, in lieu of post-leaf drop street sweeping, to implement a fall leaf litter collection program to effectively minimize leaf litter on impervious surfaces and in stormwater drainage structures. Either choice will be outlined in the permittee's SWMP.

b. Nitrogen Source Identification Report

i. Within four years of the permit effective date the permittee shall complete a Nitrogen Source Identification Report. The report shall include the following elements:

1. Calculation of total MS4 area draining to the water quality limited water segments or their tributaries, incorporating updated mapping of the MS4 and catchment delineations produced pursuant to Part 2.3.4.6,
2. All screening and monitoring results pursuant to Part 2.3.4.7.d., targeting the receiving water segment(s)
3. Impervious area and DCIA for the target catchment
4. Identification, delineation and prioritization of potential catchments with high nitrogen loading
5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment

ii. The final Nitrogen Source Identification Report shall be submitted to EPA as part of the year 4 annual report.

c. Potential Structural BMPs

i. Within five years of the permit effective date, the permittee shall evaluate all permittee-owned properties identified as presenting retrofit opportunities or areas for structural BMP installation under permit Part 2.3.6.e. or identified in the Nitrogen Source Identification Report that are within the drainage area of the impaired water or its tributaries. The evaluation shall include:

1. The next planned infrastructure, resurfacing or redevelopment activity planned for the property (if applicable) OR planned retrofit date;
2. The estimated cost of redevelopment or retrofit BMPs; and
3. The engineering and regulatory feasibility of redevelopment or retrofit BMPs.

ii. The permittee shall provide a listing of planned structural BMPs and a plan and schedule for implementation in the year 5 annual report. The permittee shall plan and install a minimum of one structural BMP as a demonstration project within the drainage area of the water quality limited water or its tributaries within six years of the permit effective date. The demonstration project shall be installed targeting a catchment with high nitrogen load potential. The permittee shall install the remainder of the structural BMPs in accordance with the plan and schedule provided in the year 5 annual report.

iii. Any structural BMPs listed in Attachment 3 to Appendix F installed in the regulated area by the permittee or its agents shall be tracked and the permittee shall estimate the nitrogen removal by the BMP consistent with Attachment 3 to Appendix F. The permittee shall document the BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated nitrogen removed in mass per year by the BMP in each annual report.

2. Upon EPA notification that the permittee is discharging to a waterbody that is water quality limited due to nitrogen, the permittee shall update their SWMP within 90 days to incorporate the requirements of Appendix H part I.1 and document the date of SWMP update. When notification occurs beyond the effective date of the permit, deadlines in Appendix H part I.1 shall be extended based on the date of the required SWMP update rather than the permit effective date.

3. At any time during the permit term the permittee may be relieved of additional requirements in Appendix H part I.1. applicable to it when in compliance with this part.

   a. The permittee is relieved of its additional requirements as of the date when one of the following criteria are met:
      i. The receiving water and all downstream segments are determined to no longer be impaired due to nitrogen by NH DES and EPA concurs with such determination.
      ii. An EPA approved TMDL for the receiving water or downstream receiving water indicates that no additional stormwater controls for the control of nitrogen are necessary for the permittee's discharge based on wasteload allocations as part of the approved TMDL.
   b. In such a case, the permittee shall document the date of the determination provided for in paragraph a. above or the approved TMDL date in its SWMP and is relieved of any additional requirements of Appendix H part I.1. as of the applicable date and the permittee shall comply with the following:
      i. The permittee shall identify in its SWMP all activities that have been implemented in accordance with the requirements of Appendix H part I.1. as of the applicable date to reduce nitrogen in its discharges, including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
      ii. The permittee shall continue to implement all requirements of Appendix H part I.1. required to be done prior to the date of determination or the date of the approved TMDL, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications.

II. <u>Discharges to water quality limited waterbodies and their tributaries where phosphorus is the cause of the impairment</u>

1. Part 2.2.2.b.i. of the permit identifies the permittees subject to additional requirements to address phosphorus in their stormwater discharges because they discharge to waterbodies that are water quality limited due to phosphorus, or their tributaries, without an EPA approved TMDL. Permittees identified in Part 2.2.2.b.i. of the permit must identify and implement BMPs designed to reduce phosphorus discharges in the impaired catchment(s). To address phosphorus discharges each permittee shall comply with the following requirements:

a. Additional or Enhanced BMPs

i. The permittee remains subject to the requirements of Part 2.3. of the permit and shall include the following enhancements to the BMPs required by Part 2.3 of the permit:

1. Part 2.3.2, Public education and outreach: The permittee shall replace its Residential and Business/Commercial/Institution program with annual timed messages on specific topics, at a minimum. The permittee shall distribute an annual message in the spring (March/April) timeframe that encourages the proper use and disposal of grass clippings and encourages the proper use of slow-release and phosphorous-free fertilizers. The permittee shall distribute an annual message in the summer (June/July) timeframe encouraging the proper management of pet waste, including noting any existing ordinances where appropriate. The permittee shall distribute an annual message in the fall (August/September/October) timeframe encouraging the proper disposal of leaf litter. The permittee shall deliver an annual message on each of these topics, unless the permittee determines that one or more of these issues is not a significant contributor of phosphorous to discharges from the MS4 and the permittee retains documentation of this finding in the SWMP.

2. Part 2.3.6, Stormwater Management in New Development and Redevelopment: the requirement for adoption/amendment of the permittee's ordinance or other regulatory mechanism shall include a requirement that new development and redevelopment stormwater management BMPs be optimized for phosphorus removal; retrofit inventory and priority ranking under 2.3.6.e. shall include consideration of BMPs that infiltrate stormwater where feasible.

3. Part 2.3.7, Good House Keeping and Pollution Prevention for Permittee Owned Operations: Establish procedures to properly manage grass cuttings and leaf litter on permittee property, including prohibiting blowing organic waste materials onto adjacent impervious surfaces; increased street sweeping frequency of all municipal owned streets and parking lots to a minimum of two times per year, once in the spring (following winter activities such as sanding) and at least once in the fall (following leaf fall). Permittees may also choose, in lieu of post-leaf drop street sweeping, to implement a fall leaf litter collection program to effectively minimize leaf litter on impervious surfaces and in stormwater

drainage structures. Either choice will be outlined in the permittee's SWMP.

b. Phosphorus Source Identification Report

i. Within four years of the permit effective date the permittee shall complete a Phosphorus Source Identification Report. The report shall include the following elements:

1. Calculation of total MS4 area draining to the water quality limited receiving water segments or their tributaries, incorporating updated mapping of the MS4 and catchment delineations produced pursuant to Part 2.3.4.6,
2. All screening and monitoring results pursuant to Part 2.3.4.7.d., targeting the receiving water segment(s)
3. Impervious area and DCIA for the target catchment
4. Identification, delineation and prioritization of potential catchments with high phosphorus loading
5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment, including the removal of impervious area of permittee-owned properties

ii. The final phosphorus source identification report shall be submitted to EPA as part of the year 4 annual report.

c. Potential Structural BMPs

i. Within five years of the permit effective date, the permittee shall evaluate all permittee-owned properties identified as presenting retrofit opportunities or areas for structural BMP installation under permit Part 2.3.6.e or identified in the Phosphorus Source Identification Report that are within the drainage area of the water quality limited water or its tributaries. The evaluation shall include:

1. The next planned infrastructure, resurfacing or redevelopment activity planned for the property (if applicable) OR planned retrofit date;
2. The estimated cost of redevelopment or retrofit BMPs; and
3. The engineering and regulatory feasibility of redevelopment or retrofit BMPs.

ii. The permittee shall provide a listing of planned structural BMPs and a plan and schedule for implementation in the year 5 annual report. The permittee shall plan and install a minimum of one structural BMP as a demonstration project within the drainage area of the water quality limited water or its tributaries within six years of the permit effective date. The demonstration project shall be installed targeting a catchment with high phosphorus load potential. The permittee shall install the remainder of the structural BMPs in accordance with the plan and schedule provided in the year 5 annual report.

iii. Any structural BMPs installed in the regulated area by the permittee or its agents shall be tracked and the permittee shall estimate the phosphorus removal by the BMP consistent with Attachment 3 to Appendix F. The permittee shall document the BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP in each annual report.

2. Upon EPA notification that the permittee is discharging to a waterbody that is water quality limited due to phosphorus, the permittee shall update their SWMP within 90 days to incorporate the requirements of Appendix H part II.1 and document the date of SWMP update. When notification occurs beyond the effective date of the permit, deadlines in Appendix H part II.1 shall be extended based on the date of the required SWMP update rather than the permit effective date.

3. At any time during the permit term the permittee may be relieved of additional requirements in Appendix H part II.1. applicable to it when in compliance with this part.

   a. The permittee is relieved of its additional requirements as of the date when one of the following criteria are met:
      i. The receiving water and all downstream segments are determined to no longer be impaired due to phosphorus by NH DES and EPA concurs with such determination.
      ii. An EPA approved TMDL for the receiving water or downstream receiving water indicates that no additional stormwater controls for the control of phosphorus are necessary for the permittee's discharge based on wasteload allocations as part of the approved TMDL.
   b. In such a case, the permittee shall document the date of the determination provided for in paragraph a. above or the approved TMDL date in its SWMP and is relieved of any additional requirements of Appendix H part II.1. as of the applicable date and the permittee shall comply with the following:
      i. The permittee shall identify in its SWMP all activities that have been implemented in accordance with the requirements of Appendix H part II.1. as of the applicable date to reduce phosphorus in its discharges, including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
      ii. The permittee shall continue to implement all requirements of Appendix H part II.1. required to be done prior to the date of determination or the date of the approved TMDL, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications.

III. <u>Discharges to water quality limited waterbodies where bacteria or pathogens is the cause of the impairment</u>

1. Part 2.2.2.c.i. of the permit identifies the permittees subject to additional requirements to address bacteria or pathogens (Enterococcus or Escherichia Coli) in their stormwater discharges because they discharge to waterbodies that are water quality limited due to bacteria or pathogens without an EPA approved TMDL. Permittees identified in Part 2.2.2.c.i. of the permit must identify and implement BMPs designed to reduce bacteria or pathogens discharges in the impaired catchment(s). To address bacteria or pathogens discharges each permittee shall comply with the following requirements:

    a. Additional or Enhanced BMPs

        i. The permittee remains subject to the requirements of Part 2.3. of the permit and shall include the following enhancements to the BMPs required by Part 2.3 of the permit:

            1. Part 2.3.2. Public Education: The permittee shall replace its Residential program with an annual message encouraging the proper management of pet waste, including noting any existing ordinances where appropriate, at a minimum. The permittee or its agents shall disseminate educational materials to dog owners at the time of issuance or renewal of a dog license, or other appropriate time. Education materials shall describe the detrimental impacts of improper management of pet waste, requirements for waste collection and disposal, and penalties for non-compliance. The permittee shall also provide information to owners of septic systems (if applicable) about proper maintenance in any catchment that discharges to a water body impaired for bacteria or pathogens.

            2. Part 2.3.4 Illicit Discharge: The permittee shall implement the illicit discharge program required by this permit. Catchments draining to any waterbody impaired for bacteria or pathogens shall be designated either Problem Catchments or HIGH priority in implementation of the IDDE program.

2. Upon EPA notification that the permittee is discharging to a waterbody that is water quality limited due to bacteria or pathogens, the permittee shall update their SWMP within 90 days to incorporate the requirements of Appendix H part III.1 and document the date of SWMP update. When notification occurs beyond the effective date of the permit, deadlines in Appendix H part III.1 shall be extended based on the date of the required SWMP update rather than the permit effective date.

3. At any time during the permit term the permittee may be relieved of additional requirements in Appendix H part III.2. applicable to it when in compliance with this part.

    a. The permittee is relieved of its additional requirements as of the date when one of the following criteria are met:
        i. The receiving water is determined to be no longer impaired due to bacteria or pathogens by NH DES and EPA concurs with such a determination.

ii. An EPA approved TMDL for the receiving water indicates that no additional stormwater controls are necessary for the control of bacteria or pathogens from the permittee's discharge based on wasteload allocations as part of the approved TMDL.

iii. The permittee's discharge is determined to meet water quality standards [1] and EPA agrees with such a determination. The permittee shall submit data to EPA that accurately characterizes the concentration of bacteria or pathogens in their discharge. The characterization shall include water quality and flow data sufficient to accurately assess the concentration of bacteria or pathogens in all seasons during storm events of multiple sizes and for the duration of the storm events including the first flush, peak storm flow and return to baseflow.

b. In such a case, the permittee shall document the date of the determination, date of approved TMDL or date of EPA concurrence that the discharge meets water quality standards in its SWMP and is relieved of any additional requirements of Appendix H part III.2. as of that date and the permittee shall comply with the following:

i. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix H part III.2. to date to reduce bacteria or pathogens in its discharges, including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs

ii. The permittee shall continue to implement all requirements of Appendix H part III.3. required to be done prior to the date of determination date, date of approved TMDL, or date of EPA concurrence that the discharge meets water quality standards, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications

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[1] Applicable water quality standards are the state standards that have been federally approved or promulgated as of the issuance date of this permit and may be compiled by EPA at http://www.epa.gov/waterscience/standards/wqslibrary/

IV. <u>Discharges to water quality limited waterbodies where chloride is the cause of the impairment</u>

1. Part 2.2.2.d.i. of the permit identifies the permittees subject to additional requirements to address chloride in their stormwater discharges because they discharge to waterbodies that are water quality limited due to chloride without an EPA approved TMDL. Permittees identified in Part 2.2.2.d.i. of the permit must identify and implement BMPs designed to reduce chloride discharges in the impaired catchment(s). To address chloride discharges each permittee shall comply with the following requirements.

2. Permittees discharging to a waterbody listed as impaired due to chloride in categories 5 or on the most recent EPA approved New Hampshire Clean Water Act section 303(d) list or New Hampshire Integrated Report under Clean Water Act section 305(b)4b shall develop a Salt Reduction Plan that includes specific actions designed to achieve salt reduction on municipal roads and facilities, and on private facilities that discharge to its MS4. The Salt Reduction Plan shall be completed within three years of the effective date of the permit and include the BMPs in Part IV 4) below. The Salt Reduction Plan shall be fully implemented five years after the effective date of the permit.

3. Permittees that, during the permit term, become aware that their discharge is to a waterbody that is impaired due to chloride must update their Salt Reduction Plan within 60 days of becoming aware of the situation to include salt reduction practices targeted at lowering chloride in discharges to the impaired waterbody. If the permittee does not have a Salt Reduction Plan already in place, then the permittee shall complete a Salt Reduction Plan that includes the BMPs in Part IV 4) below within 3 years of becoming aware of the situation and fully implement the Salt Reduction Plan within 5 years of becoming aware of the situation.

    a. Additional or Enhanced BMPs

        i. For municipally maintained surfaces:

(i) Tracking of the amount of salt applied to all municipally owned and maintained surfaces and reporting of salt use using the UNH Technology Transfer Center online tool (http://www.roadsalt.unh.edu/Salt/) beginning in the year 2 annual report;
(ii) Planned activities for salt reduction on municipally owned and maintained surfaces, which may include but are not limited to:

- Operational changes such as pre-wetting, pre-treating the salt stockpile, increasing plowing prior to de-icing, monitoring of road surface temperature, etc.;
- Implementation of new or modified equipment providing pre-wetting capability, better calibration rates, or other capability for minimizing salt use;
- Training for municipal staff and/or contractors engaged in winter maintenance activities;
- Adoption of guidelines for application rates for roads and parking lots (see NHDES, Chloride *Reduction Implementation Plan for Dinsmore*

Brook, App. J and K (February 2011), http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-13.pdf ;: *Winter Parking Lot and Sidewalk Maintenance Manual (Revised edition June 2008)* http://www.pca.state.mn.us/publications/parkinglotmanual.pdf; and the application guidelines on page 17 of *Minnesota Snow and Ice Control: Field Handbook for Snow Operators (September 2012)* http://www.mnltap.umn.edu/publications/handbooks/documents/snowice.pdf for examples);

- Regular calibration of spreading equipment;
- Designation of no-salt and/or low salt zones;
- Public education regarding impacts of salt use, methods to reduce salt use on private property, modifications to driving behavior in winter weather, etc.; and
- Measures to prevent exposure of salt stockpiles (if any) to precipitation and runoff; and

(iii) An estimate of the total tonnage of salt reduction expected by each activity; and

(iv) A schedule for implementation of planned activities including immediate implementation of operational and training measures, continued annual progress on other measures, and full implementation of the Plan by the end of the permit term.

b. For privately maintained facilities that drain to the MS4:

(i) Identification of private parking lots with 10 or more parking spaces draining to the MS4;

(ii) Requirements for private parking lot owners and operators and private street owners and operators (1) that any commercial salt applicators used for applications of salt to their parking lots or streets be trained and certified in accordance with Env-Wq 2203, and (2) to report annual salt usage within the municipal boundaries using the UNH Technology Transfer Center online tool (http://www.roadsalt.unh.edu/Salt/) or report salt usage directly to the permittee, in which case this information should be reported on the permittees annual report.

(iii) Requirements for new development and redevelopment to minimize salt usage, and to track and report amounts used using the UNH Technology Transfer Center online tool (http://www.roadsalt.unh.edu/Salt/).

4. At any time during the permit term the permittee may be relieved of additional requirements in Appendix H part IV as follows:

a. The permittee is relieved of its additional requirements as of the date when one of the following criteria are met:

i. The receiving water is determined to be no longer impaired due to chloride by NH DES and EPA concurs with such a determination.

ii. An EPA approved TMDL for the receiving water indicates that no additional stormwater controls are necessary for the control of chloride from the permittee's discharge based on wasteload allocations as part of the approved TMDL.
iii. The permittee's discharge is determined to meet applicable water quality standards[2] and EPA agrees with such a determination. The permittee shall submit data to EPA that accurately characterizes the concentration of chloride in their discharge during the deicing season (November – March). The characterization shall include water quality and flow data sufficient to accurately assess the concentration of chloride in the deicing season during storm events of multiple sizes and for the duration of the storm events including the first flush, peak storm flow and return to baseflow and include samples collected during deicing activities.

b. In such a case, the permittee shall document the date of the determination, date of approved TMDL or date of EPA concurrence that the discharge meets water quality standards in its SWMP and is relieved of any additional requirements of Appendix H part IV as of that date and the permittee shall comply with the following:
    i. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix H part IV to date to reduce chloride in its discharges, including implementation schedules for non-structural BMPs
    ii. The permittee shall continue to implement all requirements of Appendix H part IV required to be done by the date of determination date, date of approved TMDL, or date of EPA concurrence that the discharge meets water quality standards, including ongoing implementation of identified non-structural BMPs

[2] Applicable water quality standards are the state standards that have been federally approved or promulgated as of the issuance date of this permit and may be compiled by EPA at http://www.epa.gov/waterscience/standards/wqslibrary/

V. **Discharges to water quality limited waterbodies and their tributaries where solids, oil and grease (hydrocarbons), or metals is the cause of the impairment**

1. Part 2.2.2.e.i. of the permit identifies the permittees subject to additional requirements to address solids (Sedimentation/Siltation or Turbidity), metals (Cadmium, Copper, Iron, Lead or Zinc) and oil and grease (Benzo(a)pyrene (PAHs))in their stormwater discharges because they discharge to waterbodies that are water quality limited due to solids, metals, or oil and grease, without an EPA approved TMDL. Permittees identified in Part 2.2.2.e.i. of the permit must identify and implement BMPs designed to reduce solids, metals, or oil and grease discharges in the impaired catchment(s). To address solids, metals, or oil and grease discharges each permittee shall comply with the following requirements:

   a. Additional or Enhanced BMPs

      i. The permittee remains subject to the requirements of Part 2.3. of the permit and shall include the following enhancements to the BMPs required by Part 2.3 of the permit:

         1. Part 2.3.6, Stormwater Management in New Development and Redevelopment: stormwater management systems designed on commercial and industrial land use area draining to the water quality limited waterbody shall incorporate designs that allow for shutdown and containment where appropriate to isolate the system in the event of an emergency spill or other unexpected event. EPA also encourages the permittee to require any stormwater management system designed to infiltrate stormwater on commercial or industrial sites to provide the level of pollutant removal equal to or greater than the level of pollutant removal provided through the use of biofiltration as calculated using the methodologies contained in the EPA document: Stormwater Best Management Practices (BMP) Performance Analysis (2010). of the same volume of runoff to be infiltrated, prior to infiltration.

         2. Part 2.3.7, Good House Keeping and Pollution Prevention for Permittee Owned Operations: increased street sweeping and catch basin cleaning frequency of all municipal owned streets and parking lots to a schedule determined by the permittee to target areas with potential for high pollutant loads. This may include, but is not limited to, increased street sweeping frequency in commercial areas and high-density residential areas, or drainage areas with a large amount of impervious area. Each annual report shall include the street sweeping schedule determined by the permittee to target high pollutant loads.

2. Upon EPA notification that the permittee is discharging to a waterbody that is water quality limited due to solids, metals, and/or oil and grease, the permittee shall update their SWMP within 90 days to incorporate the requirements of Appendix H part V.1 and document the date of SWMP update. When notification occurs beyond the effective date of the permit, deadlines in Appendix H part V.1 shall be extended based on the date of the required SWMP update rather than the permit effective date.

3. At any time during the permit term the permittee may be relieved of additional requirements in Appendix H part V.2. applicable to it when in compliance with this part.

a. The permittee is relieved of its additional requirements as of the date when one of the following criteria are met:
    i. The receiving water is determined to be no longer impaired due to solids, metals, or oil and grease (hydrocarbons) by NH DES and EPA concurs with such a determination.
    ii. An EPA approved TMDL for the receiving water indicates that no additional stormwater controls are necessary for the control of solids, metals, or oil and grease (hydrocarbons) from the permittee's discharge based on wasteload allocations as part of the approved TMDL.
    iii. The permittee's discharge is determined to meet applicable water quality standards and EPA agrees with such a determination[3]. The permittee shall submit data to EPA that accurately characterizes the concentration of solids, metals, or oil and grease (hydrocarbons) in their discharge. The characterization shall include water quality and flow data sufficient to accurately assess the concentration of solids, metals, or oil and grease (hydrocarbons) in all seasons during storm events of multiple sizes and for the duration of the storm events including the first flush, peak storm flow and return to baseflow.
b. In such a case, the permittee shall document the date of the determination, date of approved TMDL or date of EPA concurrence that the discharge meets water quality standards in its SWMP and is relieved of any additional requirements of Appendix H part V.2. as of that date and the permittee shall comply with the following:
    i. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix H part V.2. to date to reduce solids, metals, or oil and grease (hydrocarbons) in its discharges, including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
    ii. The permittee shall continue to implement all requirements of Appendix H part V.3. required to be done by the date of determination date, date of approved TMDL, or date of EPA concurrence that the discharge meets water quality standards , including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications

[3] Applicable water quality standards are the state standards that have been federally approved or promulgated as of the issuance date of this permit and may be compiled by EPA at http://www.epa.gov/waterscience/standards/wqslibrary/